POWER

NOVEMBER, 1944

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DETROIT

POWER GENERATION, TRANSMISSION, APPLICATION AND THE ATTENDANT SERVICES IN ALL INDUSTRY

Pumproom of new semi-outdoor boiler plant, Richfield Oil Corp's Los Angeles refinery

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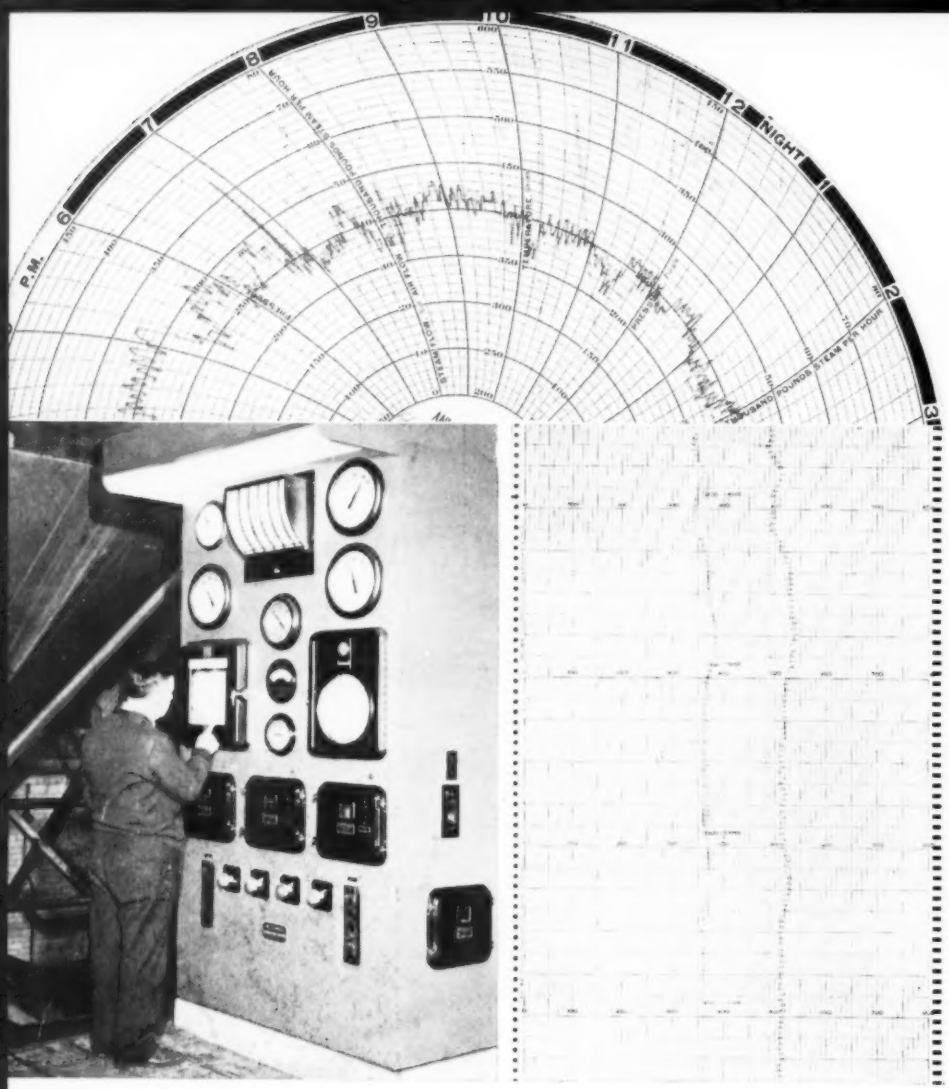
Page 59

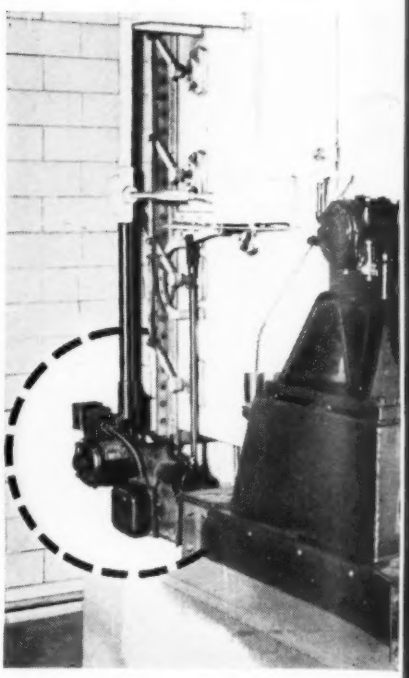
World's largest internal-combustion-engine plant—68 units, 78,000 kw—at Alcoa's Jones Mills Works produces low-cost power from cheap natural-gas fuel at site remote from available hydro power. Sound engineering overcomes problems of multiplicity of units and yields effective, conveniently operated layout. Starts page 64

Good lighting in control rooms pays dividends in improved operation. Specialists show, in detail, how to put right light in right place, arrange instruments and select scales. Turn to page 78



Top—Bleeding of turbines for process steam causes the swings shown on Utica Knitting Co.'s stoker-fired boilers.
Left—Boiler Panel with Metermax Combustion Control and Micromax Temperature Recorder.
Right—Typical section of Micromax Chart.

ARMY NAVY
V depends on me!
A Slogan For Every American



Metermax-controlled Electric Drive Unit on inlet vanes of forced-draft fan.

HIGH BOILER EFFICIENCY?

Utica Knitting Co. Gets it With Metermax Combustion Control

Faced a few years ago with heavier demand for its products, the big Utica (N. Y.) Knitting Co. translated that demand into steam, took a careful look at its steam plant, and decided to install more capacity—at once. Out came some old boilers, up went a new building, and into it went a 50,000 lb/hr C. E. stoker-fired boiler, to supply 225 lb steam at 100 degrees superheat.

Prominent among the problems to be solved was, of course, how to operate this big unit? How to give U. K. Co.'s firemen the kind of help they would need with a boiler so totally different from the ones they were used to? How to operate this unit in parallel with their remaining older and much smaller boilers?

The answer is in the pictures herewith. Metermax Combustion Control has the flexibility that boiler operators need; any adjustment can be changed at any time; the unit can be returned partly or entirely to manual control by turning a single switch on the boiler panel.

And Metermax has the sensitivity needed for efficiency; the full sensitivity required for powdered-coal boilers in central stations is built into every Metermax.

Furthermore, Metermax is simple: its controllers are pneumatic-electric; and its drive units are entirely electric. No line shafting; no hydraulic or pneumatic lines; no connection between panel and drive unit except a single conduit run.

The Metermax Panel reaches you complete, ready for outside connection to fans, feeders, etc. We will if you wish assemble and mount all gauges, indicators and other accessories. We do excellent work of this kind!

If you have a boiler-control problem, outline it and an L&N engineer will gladly try to help. Or if a compact, fully-illustrated catalog will meet your needs, ask for N-01M-163.

TYPE P COMBUSTION CONTROL; COMPANION TO METERMAX

If your plant does not require the central-station characteristics of Metermax Combustion Control, we recommend Type P Control. It is simple, sensitive and thoroughly dependable. Ask for Catalog N-01P-163.

Jrl Ad N-01M-163(1)

LEEDS & NORTHRUP COMPANY, 4910 STENTON AVE., PHILA., PA.
LEEDS & NORTHRUP
MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

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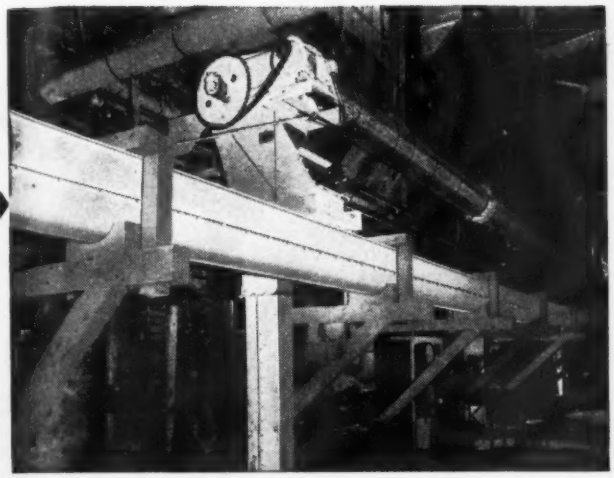
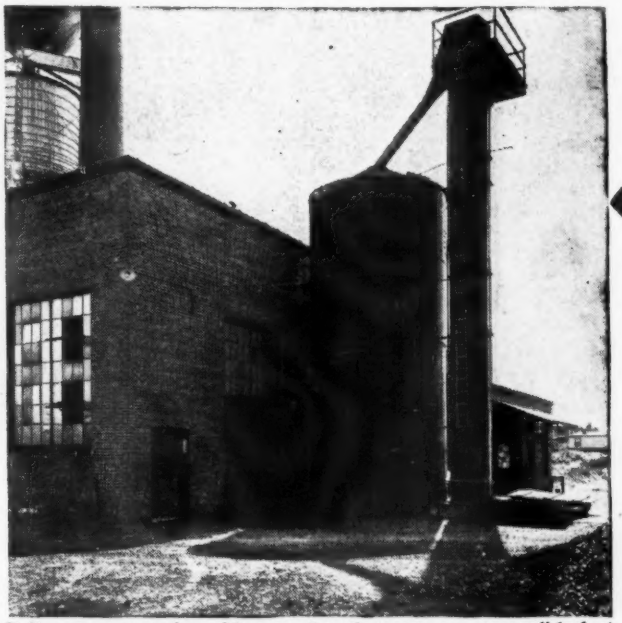
LINK BELT

COAL AND ASHES HANDLING EQUIPMENT

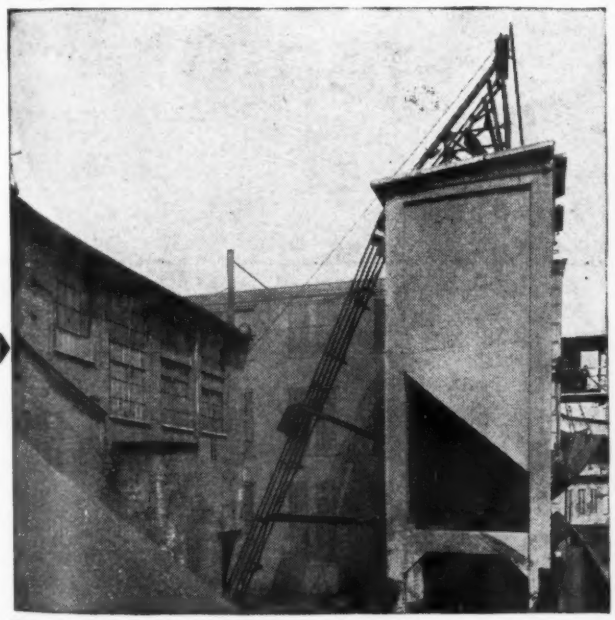
MODERNIZATION OF HANDLING METHODS SOLVED PROBLEMS FOR THESE SMALL AND MODERATE SIZE PLANTS



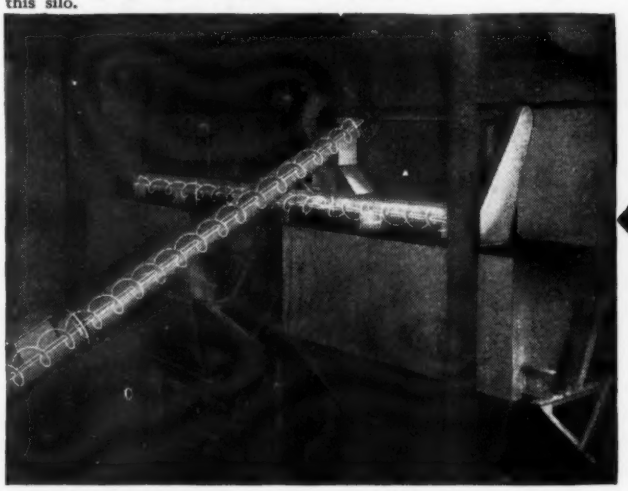
A combination Bulk-Flo elevator-feeder and horizontal screw conveyor which delivers coal from storage pile outside of boiler room, direct to boilers. This equipment replaced a time and labor-wasting practice of carting coal in wheelbarrows and firing by hand.



Boiler room expansion with covered coal storage was accomplished at this laundry without enlarging or raising roof of building or bunkers. Link-Belt elevator takes coal delivered by truck to silo with 20 ton live and 80 ton dead storage. Coal is spouted direct to boilers from this silo.



This skip hoist, solved an ashes removal problem by avoiding difficulties such as rapid wear and excessive costs experienced with two previous installations. Ashes are discharged from a dump car at basement floor level, directly to the skip bucket which is automatically hoisted, dumped, and returned by push button control.

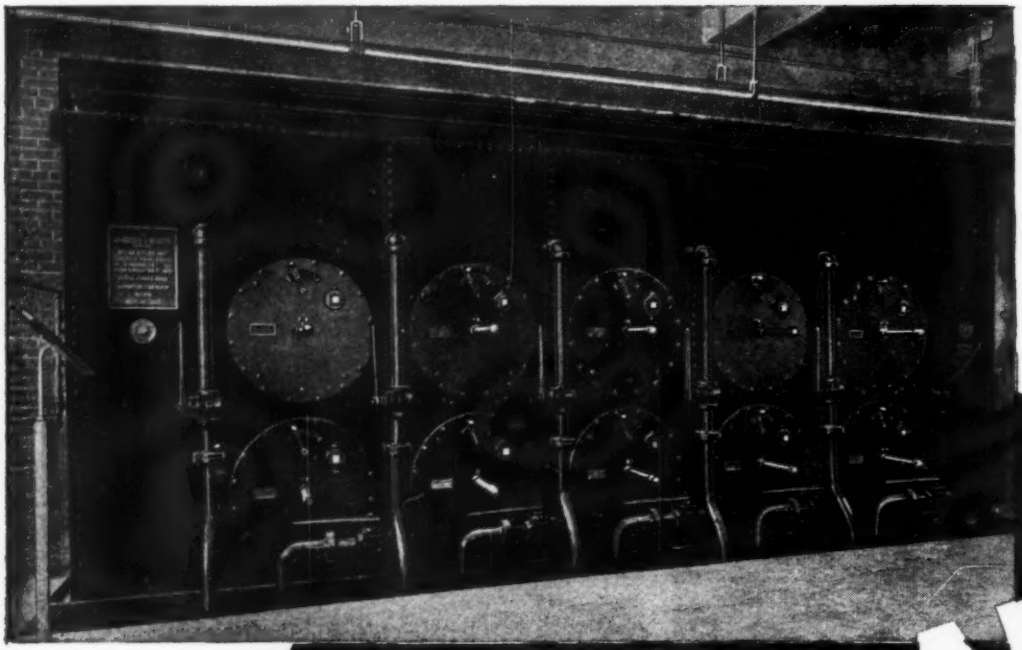


Mechanical handling of coal from concrete bin at one side of boiler room to stoker hoppers through this inclined Rotor Lift (screw) conveyor and horizontal distributing screw conveyor, completely eliminated a coal dust nuisance at an Indianapolis hospital. Both conveyors are operated from a 5 H.P. motor.

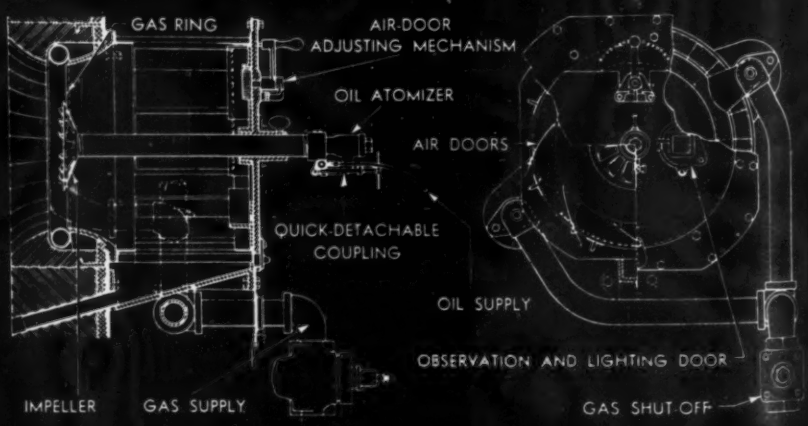
9664

Whether your plant is large or small, and no matter what your conditions might be, there is suitable Link-Belt equipment to meet every requirement. Before you do anything else about it, talk over your problem with an experienced Link-Belt engineer. Send for book No. 1510, "Solving the Problem of Coal and Ashes Handling."

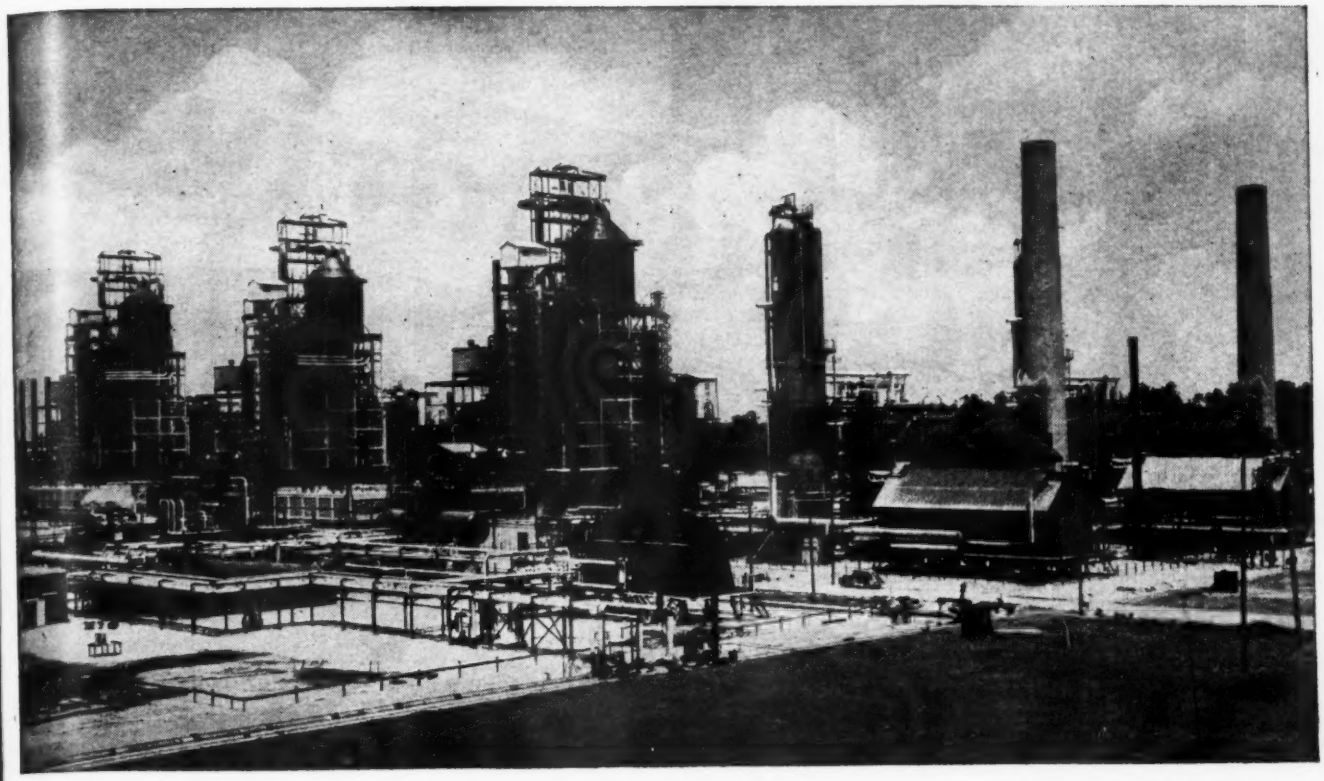
LINK-BELT COMPANY Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Dallas 1, Minneapolis 5, San Francisco 24, Toronto 8. Offices in principal cities.



THIS TEAM



Combination fuel gas and oil burners of this type are installed on boilers at Lake Charles.



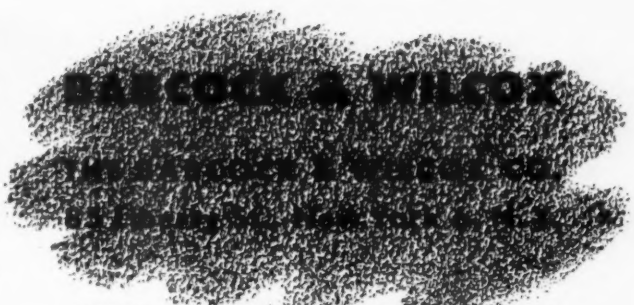
View of Topping Units (right) and three Cracking Units (left) at new Lake Charles plant of Cities Service.

Lake Charles

Six Babcock & Wilcox boilers help to provide power and process steam for the new giant Cities Service refinery at Lake Charles, Louisiana. Two are the B&W Integral-Furnace type, and teamed with them are 23 B&W burners on these and other boilers in the plant.

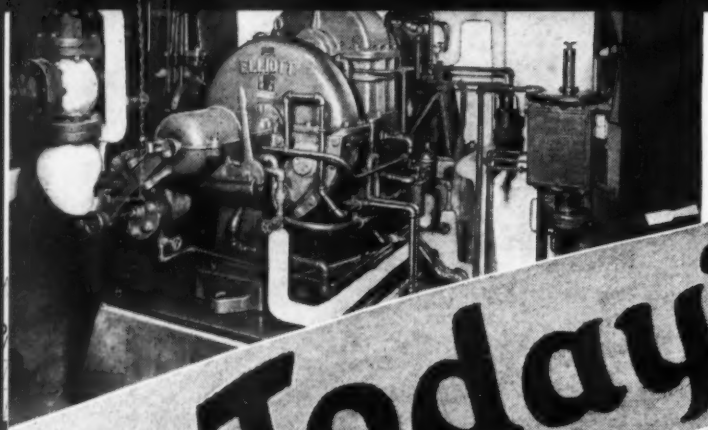
Providing tankfuls for task fliers calls for uninterrupted production . . . makes "steam up" as important as "on stream" . . . demands a high standard of efficient performance from generating equipment. B&W Integral-Furnace Boilers are a "known quantity", proved dependable in war industries as in pre-war services . . . now serving steel mills as well as refineries; arsenals and aircraft factories as well as butadiene plants.

Experience gained in unprecedented war-time assignments added to years of steam progress, will be reflected in the service of B&W Integral-Furnace Boilers to post-war industry.



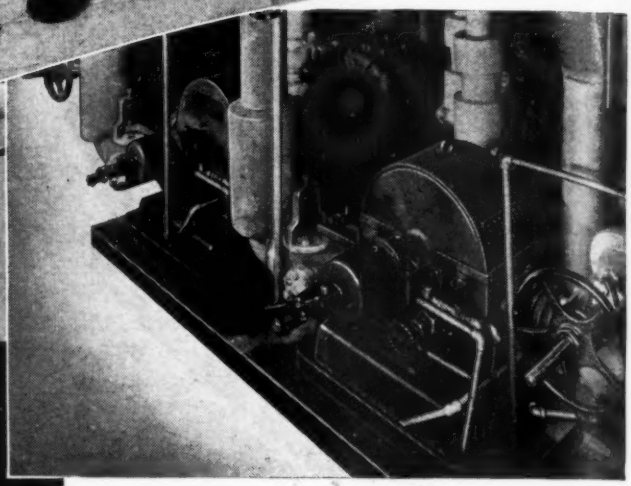
G-276T

Today's drives



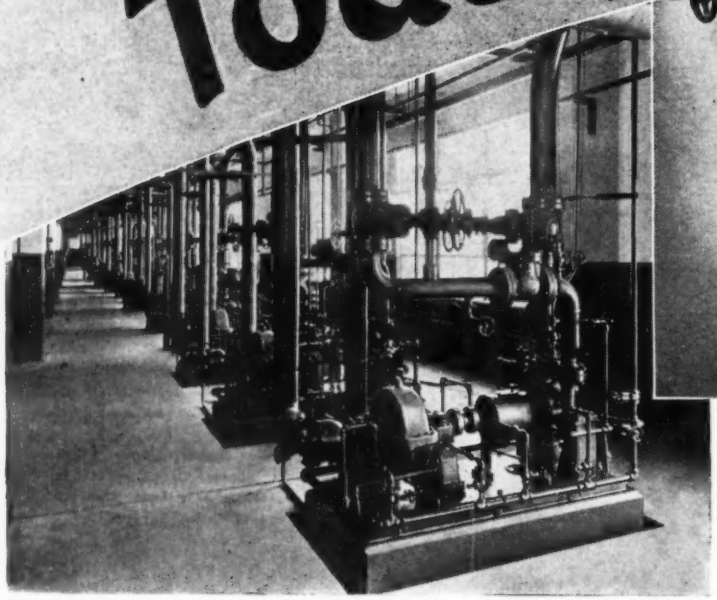
PUMPS

Elliott turbine with built-in gear driving an induced draf. fan in the steam generating plant of a large aircraft manufacturer.

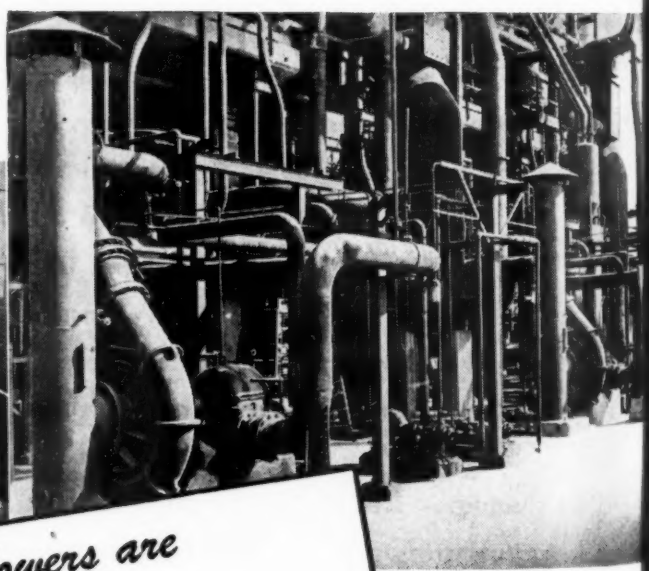


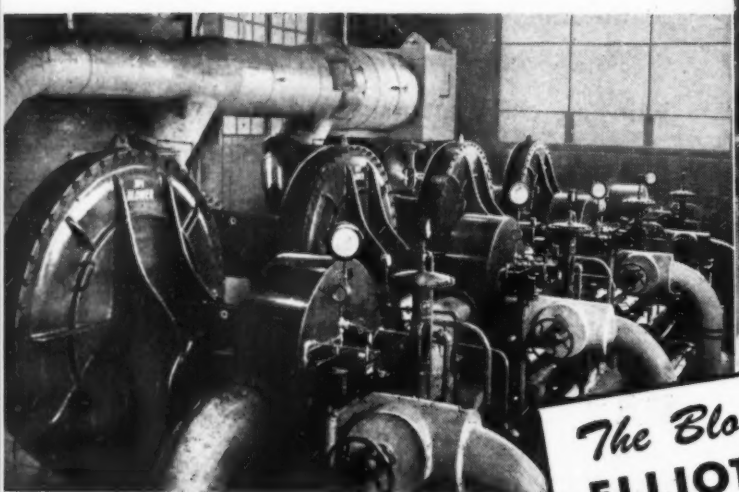
PUMPS

These Elliott turbines are typical of hundreds driving boiler-feed pumps in all sorts of steam plants.



PUMPS A long line of Elliott turbines direct-connected to pumps in a high-octane gasoline refinery.





BLOWERS Four Elliott turbines direct-connected to Elliott blowers handling flue and kiln gas in a magnesium plant. Turbines are equipped with variable speed oil type governors.

The Blowers are **ELLIOTT** *too*

The blowers in the photographs above are built by Elliott as well as the turbines which drive them. Elliott blowers, too, are sturdy and dependable, rugged and heavy, giving practically vibrationless and quiet operation.

BLOWERS

Three Elliott blowers in cata cracking service, driven by E condensing turbines operatin 500 lb, 600 deg steam. Ou installation. Other Elliott tur are driving pumps.

ELLIOTT COMPANY

Steam Turbine Dept., JEANNETTE, P.A.

DISTRICT OFFICES IN PRINCIPAL CITIES

STEAM TURBINE

HEATERS AND DEAERATO

FOR DIESEL ENGINE

demand dependable

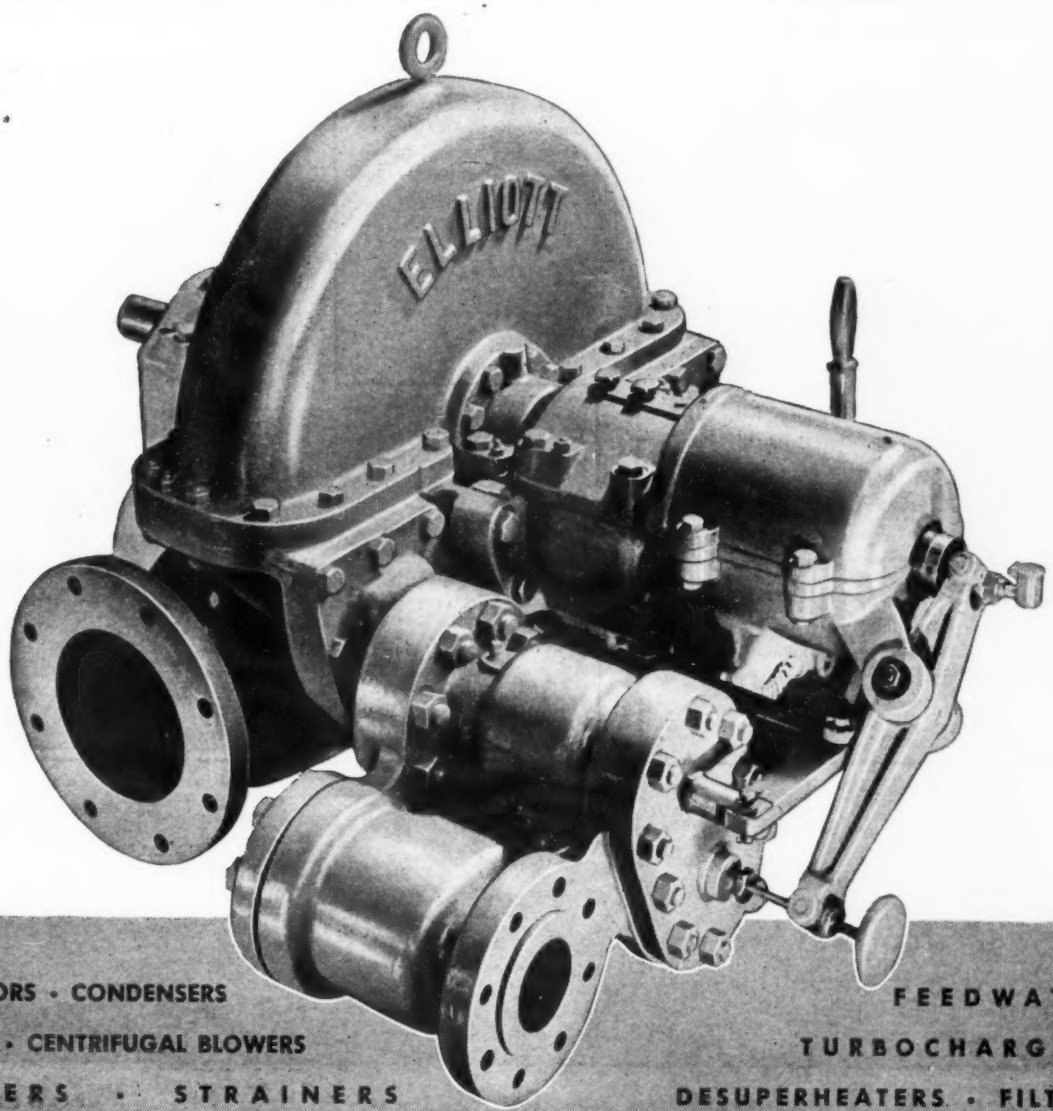
ELLIOTT Turbines

Reliability was always important in mechanical drive turbines. Today's conditions demand it more than ever before. Around-the-clock, 24-hour service is the usual thing. Units have to stay on the line "in spite of hell or high water." On top of that, in many plants there are no standby units, due to wartime curtailment.

The Elliott turbines pictured are all on 24-hour service, many in plants making critical war materials such as high-octane gasoline, magnesium, etc. These Elliott turbines, as expected, are giving a good account of themselves and are proving that they have "got what it takes" for continuous non-stop service.

Elliott turbines, you probably know, are always heavier, are more substantially built, have more material in them than the usual turbine. This gives the added factor of safety required for wartime service. At the same time, they have all of the refinements and safety features you require of a steam turbine.

Construction details are given in descriptive bulletins sent on request. An Elliott turbine engineer near you will be glad to talk over your specific job and make suggestions.



H-636

ENERATORS • MOTORS • CONDENSERS
TEAM JET EJECTORS • CENTRIFUGAL BLOWERS
UBE CLEANERS • STRAINERS
FEEDWATER
TURBOCHARGERS
DESUPERHEATERS • FILTERS

DIAMOND AUTOMATIC SEQUENTIAL

When a boiler is equipped with Diamond Automatic Sequential Air Puff Soot Blowers, none of the situations you see illustrated at the right can happen. In the first place, there is no attendant because the entire soot blowing system is operated by simply opening a valve on master controller or by pushing a "start" button on a program panel which can be a part of the boiler and turbine control board.

Then, being automatically controlled, the soot blowers always operate in the same sequence and with the same blowing time. No blower unit can be overlooked or incorrectly operated. Should it ever be found necessary to change the blowing sequence, it is easily accomplished by a simple change on the master controller.

The compressed air—having a greater density than steam—provides theoretically better cleaning. The air is discharged from the element nozzles in a series of short puffs with substantial pauses between. Spreading the cleaning cycle over a longer period of time permits use of a very small compressor.

This Diamond equipment has been in very successful central station use since 1940. For further information, write for Bulletin No. 956 which illustrates and describes an installation on a 900,000 lb/hr boiler in a modern eastern central station.

Other Features

SAVES LABOR

—no attendant needed to drain piping, warm it up and operate each individual blower.

NO FEED WATER MAKEUP

—using compressed air instead of steam.

SAVES FUEL

—uses only ⅓ to ⅔ of energy from coal pile that is needed for steam blowing.

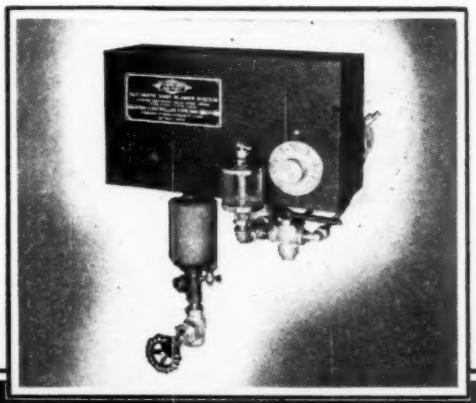
ELIMINATES STACK DISCHARGE NUISANCE

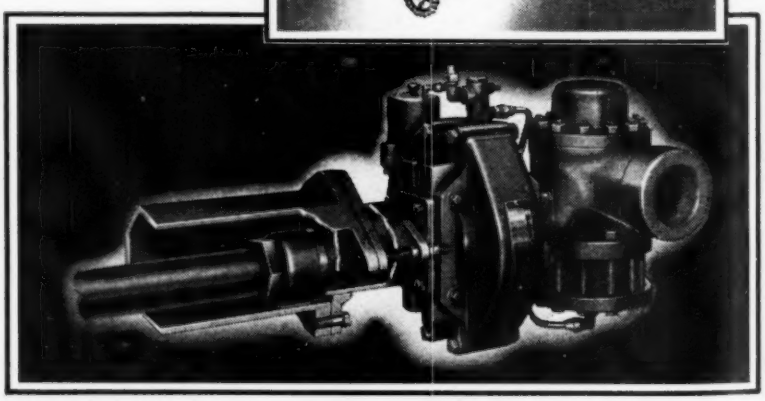
—intermittent operation expels soot from boiler in small quantities.

REDUCES MAINTENANCE

—experience on boilers in operation since 1940 proves maintenance unusually low.

(Right) Master Controller which automatically controls the sequence and blowing time of Diamond Air Puff Soot Blowers (see below) having elements permanently installed inside the setting.

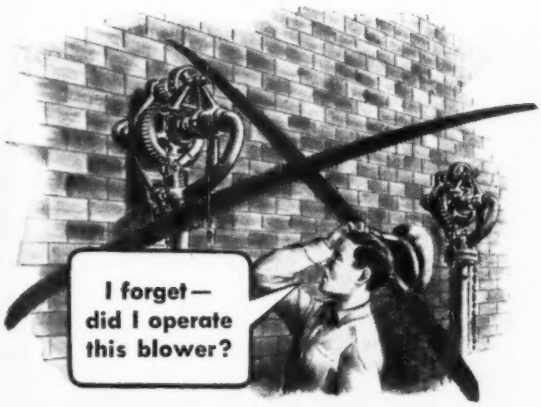


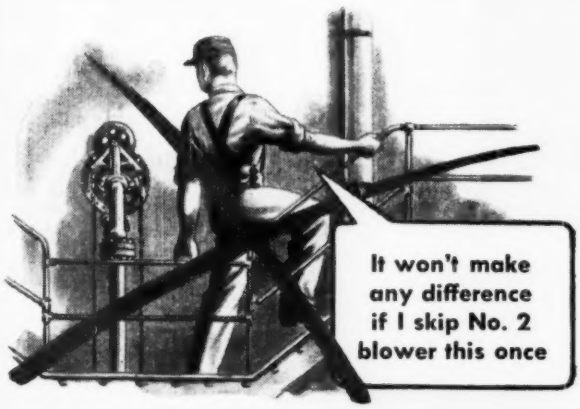


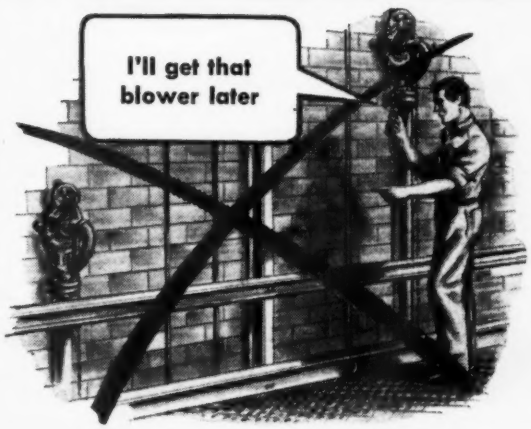
DIAMOND POWER

"Air Puff" SOOT BLOWING

Eliminates THE HUMAN ELEMENT and Assures CORRECT BOILER CLEANING







SPECIALTY CORP. DETROIT 31, MICHIGAN

DIAMOND SPECIALTY LIMITED • Windsor, Ontario

*UNIFORMITY

TIDE WATER LUBRICANIA

DEFINITION: The uniformity of a lubricant is generally understood to mean the conformity in certain specified essential qualities between two or more separate "lots", "batches", or drums of lubricant.

EXPLANATION: In general a slight variation between drums of lubricant in one or more qualities —carbon residue, pour point, specific gravity, etc.—may not have any noticeable effect on the performance of the lubricant. However, if there is a variation in more than one quality—or if the variation occurs in a quality that has a critical bearing on a specific service for which the lubricant is used (i.e., Demulsibility of Steam Cylinder Oils)—then a serious variation in lubricant performance is likely to result.

TEST: There is no single test that can be made to determine uniformity. In practice, each "batch" of lubricant must conform to certain prescribed test limits. The lubricant is tested for certain specific qualities, depending on the service in which it is to be used. Tests may be made for Viscosity, Flash Point, Carbon Residue, Pour Point, Neutralization Number, Penetration, Specific Gravity, Color, or any other pertinent factors.

CONCLUSION: Most reputable refiners and marketers of lubricating oils, greases, and compounds recognize the extreme importance of maintaining uniformity. For this reason their entire manufacturing and testing procedure is scientifically conducted and strictly controlled. Regular testing by skilled technicians, using modern test equipment, provides a further means of assuring the continuing uniformity of each specific lubricant.

INDUSTRIAL TYCOL OILS-GREASES

GASOLINE POWERS THE ATTACK—
DON'T WASTE A DROP

SCIENTIFICALLY ENGINEERED
FOR EVERY INDUSTRIAL USE **TYCOL**

✱ This is the 13th of a series of informative messages concerning the meaning and significance of commonly used tests and terms employed to describe the characteristics of lubricating oils.

INDUSTRY'S widespread preference for Tycol oils and greases results in part from their unquestioned uniformity within each classification — from the first drum to the thousandth. Equally important is the skill with which they are engineered to meet the specific requirements of each type of service.

Whatever your lubricating need, there is a Tycol lubricant that will do the job with uniformly satisfactory results. Let a Tide Water engineer help you select the best one for your particular need. Call or write any Tide Water office for further details.

DRUMS! DRUMS! DRUMS!
War needs make it extremely important that all empty drums be returned immediately.

TIDE WATER ASSOCIATED OIL COMPANY

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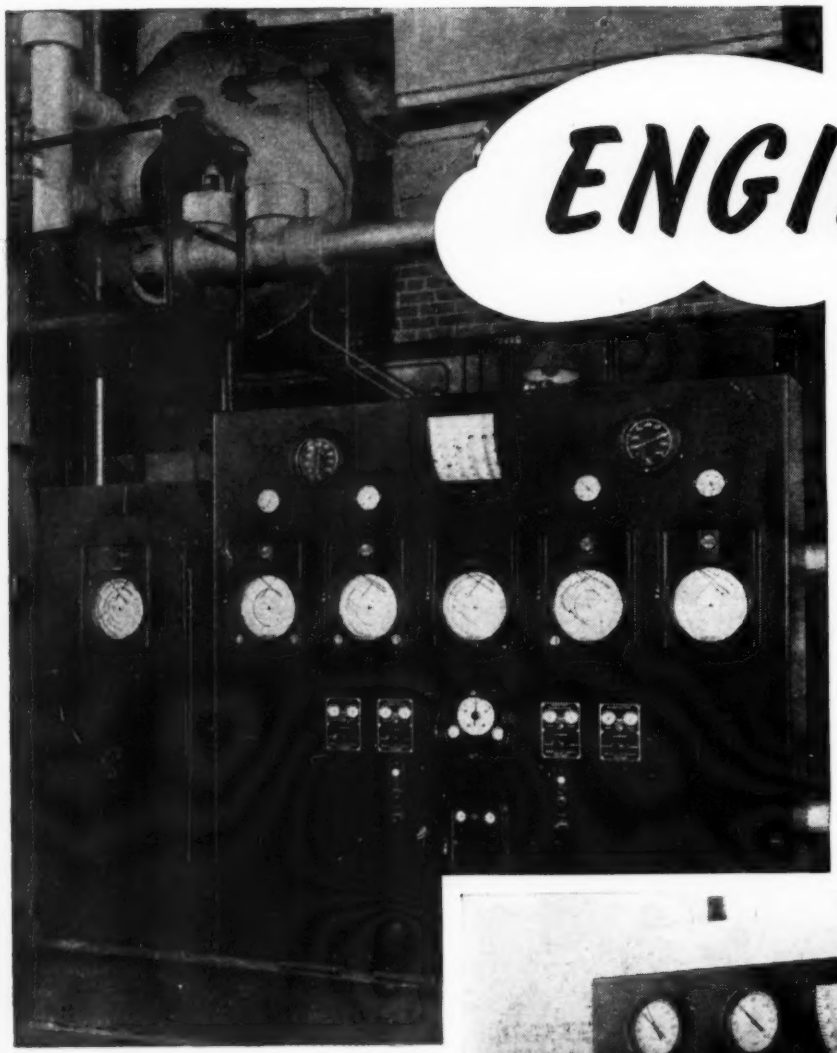
INDUSTRIAL LUBRICANTS

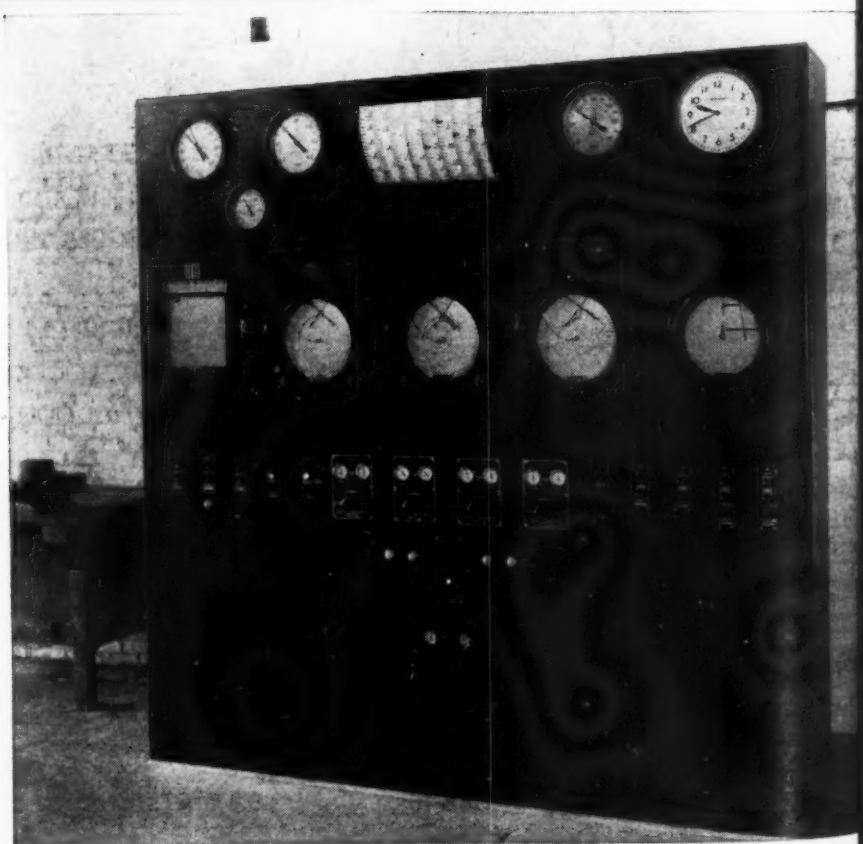


ENGINEERED

★ ★

This Bailey Boiler Control System for Combustion and Feed Water is engineered to a 450 psi, 120,000 lb. per hr. capacity natural gas fired boiler to secure optimum results in everyday operation.

A 200 psi, 100,000 lb. per hr. capacity stoker fired boiler is operated at a continuous efficiency of 87% by this Bailey Combustion and Feed Water Control System.



BAILEY METERS

BAILEY METER CONTROL

BOILER METERS • MULTI-POINTER GAGES • FLUID METERS • RECORDERS • SUPERH

INSTRUMENTATION Conserves Fuel

★ Maximum fuel conservation is obtained when a boiler plant is operated so that the sum of all controllable heat losses is a minimum. This condition is usually reached when excess air has been reduced to the point where losses from unburned fuel and CO cancel any advantage gained by further reduction of excess air.

Often the amount by which excess air may be reduced is limited by other factors such as refractory deterioration, smoke, and superheat control.

The key to fuel conservation is a correct determination of the optimum excess air value at which each boiler unit should be operated. This value is determined by combustion tests made under actual operating conditions. Once determined, the optimum value is used in setting the Bailey Boiler Meter and from then on fuel economy is simply a matter of vigilance on the part of manual operators or the automatic control system.

This approach makes it possible to conform with war conservation measures through increased efficiency rather than at the sacrifice of product output. It is a procedure by which the experience gained in the most efficient power plants may be put to use in power plants everywhere. It is engineered instrumentation based on the particular requirements of each boiler unit.

To quickly and efficiently serve Power Engineers in this all important phase of instrumentation, Bailey Engineers are located in over 30 industrial areas throughout the United States and Canada. The Bailey Engineer in your community has a wide background of combustion engineering know-how at his command. It covers combustion tests on thousands of boiler installations including a wide range of fuels, furnaces and fuel burning equipment. He is in a position to help you not only with the problem of fuel conservation but also with other problems such as safety, steaming capacity, conservation of man power and continuity of power service.

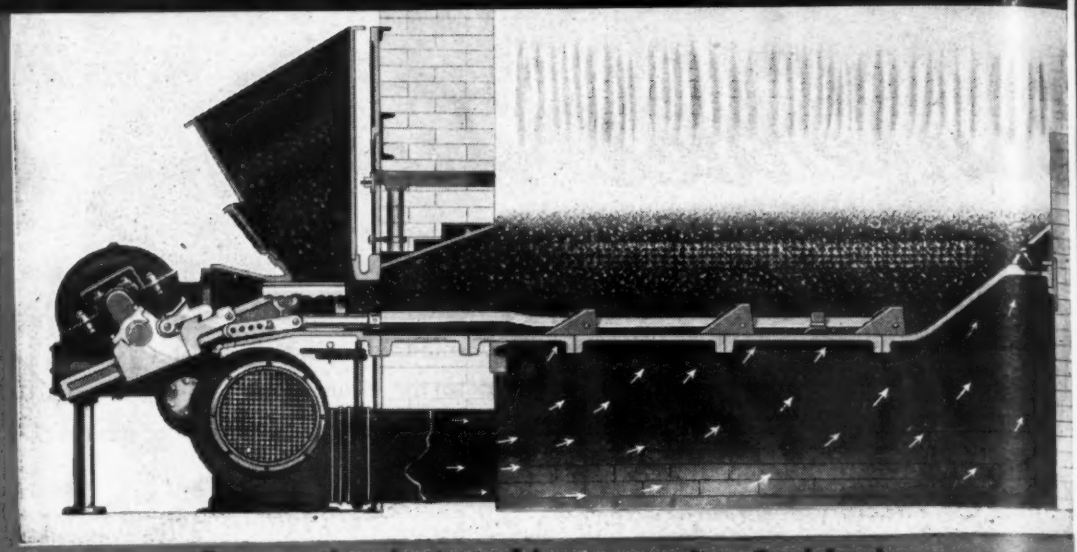
BAILEY METER COMPANY
1036 IVANHOE ROAD • CLEVELAND 10, OHIO
Bailey Meter Company Limited, Montreal, Canada

G-20

The Complete Combustion Control System

DESUPERHEAT CONTROL • COMBUSTION CONTROL • FEED WATER CONTROL

IT'S THE DESIGN



Deep sectional retort of large capacity. Coal feed and distribution by dependable plunger feed.

DETROIT UNISTOKER

Provides flexibility to handle fluctuating loads.

HEAVY MECHANICAL DRIVE REQUIRES LITTLE POWER
SAFETY SHEARING PIN
HAND COAL ADJUSTMENT
AUTOMATIC ADJUSTMENTS OF COAL AND AIR SUPPLY

DETROIT ADJUSTABLE FEED
(COAL FEED CONTROL)

DETROIT STOKER COMPANY

and **APPLICATION**

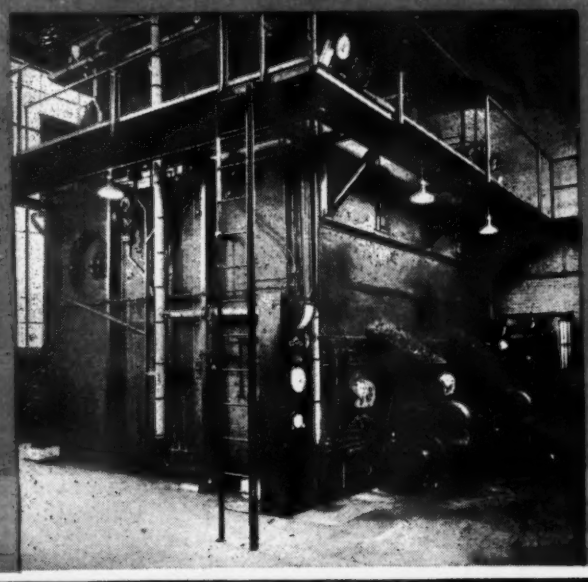
DETROIT UNISTOKER

Saves Fuel and Labor

AUTOMATICALLY CONTROLLED

Feeds coal only when needed. None is wasted. Grate area is large. All of the fuel bed is active. Burning rate per square foot of grate is low. Side Cleaning—ashes are discharged to ash pits at each side of furnace. Design is simple and compact. A proven success. Readily applied to all boiler types. Thousands in Daily Operation.

In Virginia—
with Low Head Bent Tube Boilers

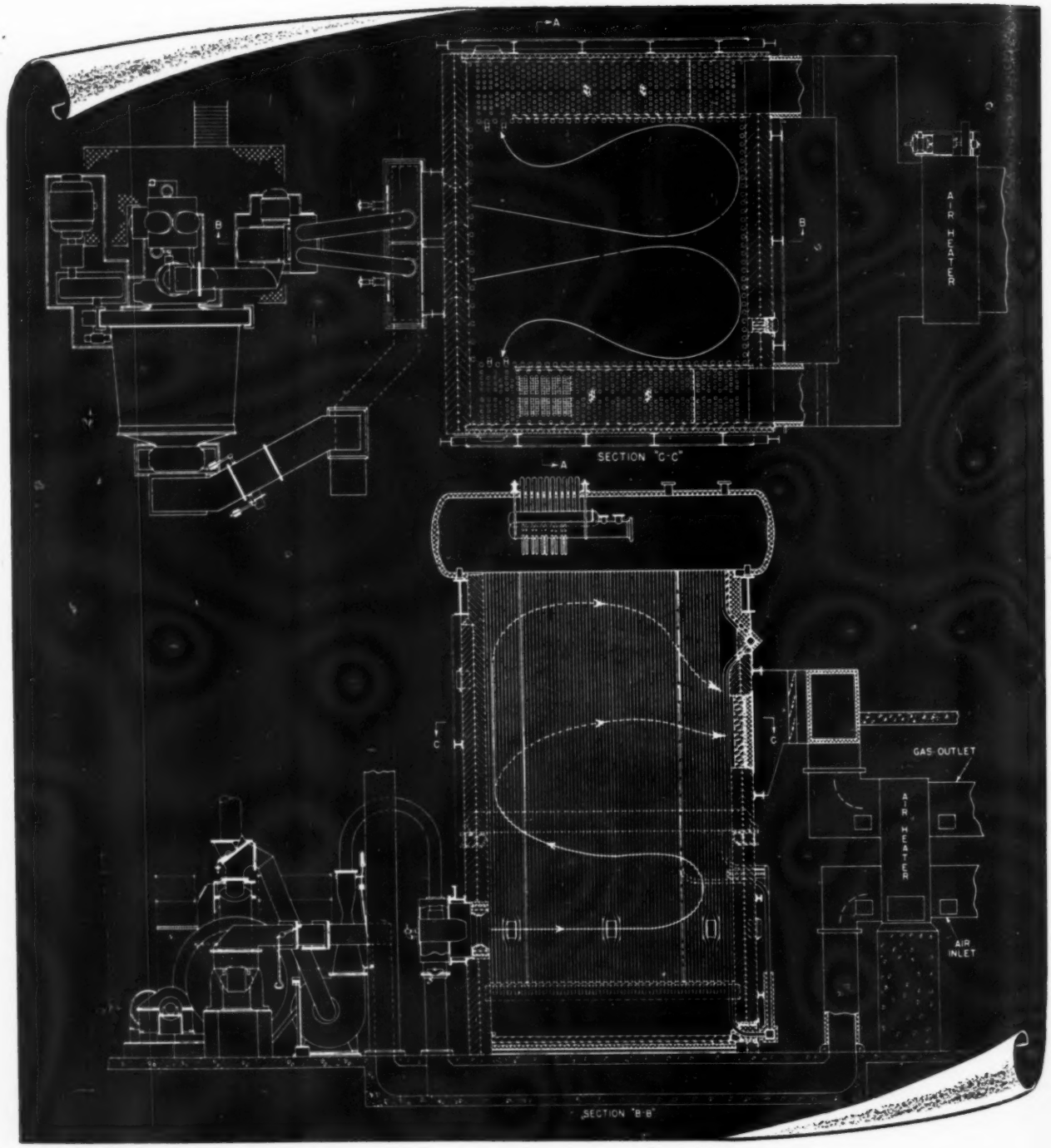


In Pennsylvania—
with Steam Generators.

GENERAL MOTORS BUILDING • DETROIT 2, MICHIGAN

Works at Monroe, Michigan • District Offices in Principal Cities • Built in Canada at London, Ontario

Reverse Firin



FW FOSTER

Reduces . . .

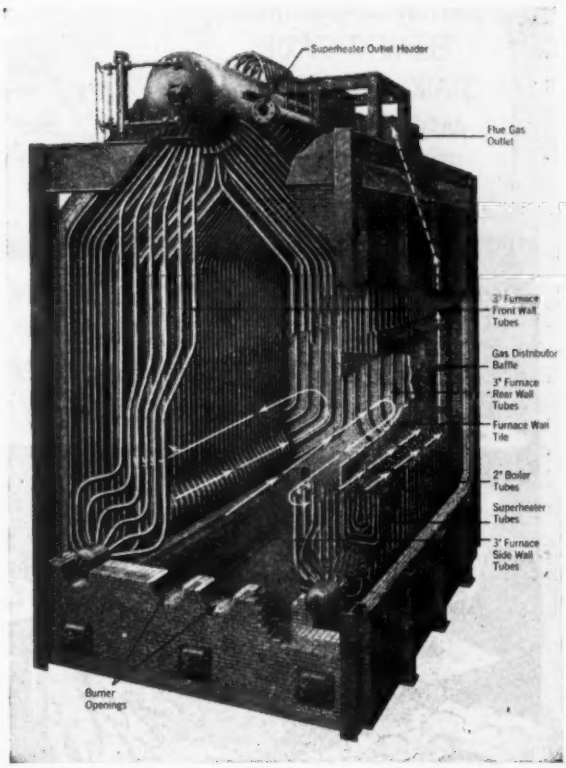
- ✓ CARBON LOSS
- ✓ ASH CARRIED *INTO* BOILER
- ✓ SLAGGING *OF* BOILER

AND SUPERHEATER

Reverse Firing

—GASES TWICE TRAVEL THE LENGTH OF THE FURNACE—IS A PATENTED FEATURE USED IN THE "S-A" STEAM GENERATOR

●



FOSTER WHEELER CORPORATION
165 BROADWAY NEW YORK 6, N. Y.

WHEELER

Prepared for ACTION!

YOU'RE SURE TO GET TOP-FLIGHT DRIVE PERFORMANCE WHEN YOU SPECIFY ALLIS-CHALMERS TEXROPE V-BELTS . . . EACH BELT IS DESIGNED, TESTED AND BUILT TO SOLVE SPECIFIC DRIVE PROBLEMS

♪ *Tune in the Boston Symphony, Blue Network, every Sat. Eve.*

REALLY BAD OIL CONDITIONS ARE MY OBJECTIVES. I'M SUPER-7 OIL-PROOF...MADE OF SOLID NEOPRENE. GRIMY LIQUIDS DON'T BOTHER ME.
OIL
SUPER-7 STATIC-RESISTING TALKING: MY BUILT-IN CONDUCTING ELEMENT CARRIES STATIC CHARGES TO MACHINES WHERE THEY'RE GROUNDED.
HEAVY LOADS? EASY! MY STEEL CABLES ADD POWER, REDUCE STRETCH AND SLIPPAGE. I'M SUPER-7-STEEL.
90% OF ALL OIL CONDITIONS ARE A CINCH FOR ME. NEOPRENE IS MY COVER..SUPER-7 OIL-RESISTING, MY NAME.
HOT-RUNNING DRIVES ARE WHERE I SHINE. 180°F IS JUST COMFORTABLY WARM FOR SUPER-7 HEAT RESISTING. THAT'S ME.
A 1771

IT PAYS TO MAKE ALLIS-CHALMERS YOUR V-BELT DRIVE HEADQUARTERS

Texrope Super-7 V-Belts result from the cooperative research of two great companies—Allis-Chalmers and B. F. Goodrich—and are sold exclusively by A-C.

CAPACITORS REDUCE YOUR KVA DEMAND

"The capacitors reduced the demand of our welders from 150 kva to 54.6 kva. A serious wiring and power-factor problem within our factory was solved, and a bad light flicker was eliminated."

. . . An Illinois engineering firm

THEY BOOST A CIRCUIT'S LOADABILITY

"The 90 kva of capacitors increased our capacity 30 per cent. We've been able to connect more motors, without adding to wire, main switch, fuse, or transformer capacity."

. . . A Nebraska iron foundry

THEY IMPROVE VOLTAGE AND PERFORMANCE OF EQUIPMENT

"Voltage improved . . . power factor now unity . . . production speeded up . . . lighting flicker eliminated."

. . . A Michigan steel company

THEY REDUCE YOUR POWER COSTS *(if your power contract contains a power-factor or kva-demand clause)*

"With a total expenditure of $13,000 our savings have averaged $1000 monthly."

. . . An automobile manufacturer, Detroit

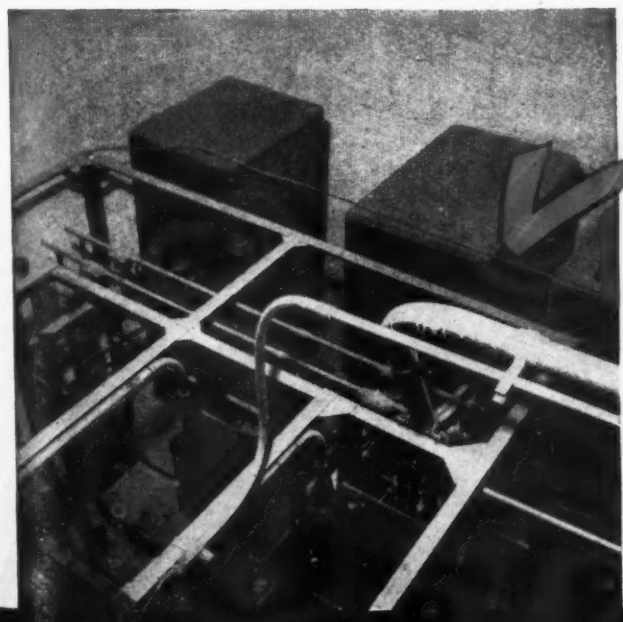
THEY SAVE MATERIAL

"Almost 50,000 pounds of critical material would have been required if new circuits had been added. With capacitors, only 4000 pounds of material was needed."

. . . A Midwestern paper manufacturer

THEY EASE RECONVERSION PROBLEMS

Capacitor equipments are assemblies of small, compact, individual units, easy to connect or disconnect, easily regrouped and moved to new locations—to serve your peacetime loads. They may make it unnecessary for you to relocate other heavier electric equipment.



PYRANOL CAPACITORS

◄**CAPACITORS AUTOMATICALLY SWITCHED**—The Allied Mills, Inc., Buffalo, N. Y., put in three banks of Pyranol capacitors totaling 200 kva to correct a bad power-factor condition that affected 1136 hp of motors. One bank has a hand-operated switch; the two other banks have automatic switches, actuated by a current transformer and relays, which connect or disconnect the capacitors with the rise and fall in the kva demand.

If your plant's power system is fully loaded—or overloaded—and is operating at low power factor, ask your G-E representative to estimate how much your circuit capacity can be increased by Pyranol capacitors. Or write for Bulletin GEA-77. General Electric Company, Schenectady 5, N. Y.

**Reg. U.S. Pat. Off.*

BUY WAR BONDS

GENERAL ELECTRIC

DO YOU KNOW

THESE SIX ADVANTAGES OF THE NO-BLO TUYERE?

A TUYERE, though small, is a mighty important part of a stoker. Things can happen to it which defeat the purpose of fuel firing equipment—the generation of steam—continuously and at low cost.

The tuyere now available on Taylor Stokers climaxes many years of development—and answers the requirements of cold or preheated air. Its use, under severe conditions, has shown an increase in efficiency, in life, and in fuel burning rate at the same time accompanied by a lowered maintenance rate.

These are 6 specific reasons for this:

1. Improved design of air channels and air discharge—more finely divided streams of air.
2. Locking lug removed from nose—fastening remains intact even if nose is burned away.
3. High ratio of cooling area to heat absorbing area—means a cooler tuyere and longer life.
4. Less horizontal area per tuyere—smaller steps—less resistance to movement of fuel bed.
5. Fewer burnouts and longer life because of unique undercut fin construction. In the No-Blo design the fins terminate before reaching the edge of the tuyere toe, forming a peripheral air channel when slag blocks the air vents. Thus continuous proper air flow and air cooling is assured.
6. Greater coal burning capacity—less replacement expense.

Yes, the No-Blo Tuyere is just one of the features responsible for the efficient, reliable operation of the Taylor Stoker in generating steam at low cost. But it is an important one.

JUDGE THE SELECTION OF FUEL FIRING EQUIPMENT BY THESE TWELVE POINTS

1. RELIABILITY—the ability to operate with minimum outage and minimum standby equipment.

2. CAPACITY—the ability to provide adequate prime capacity ratings, with sufficient reserve capacity for emergencies.

3. MAINTENANCE—the ability to operate continuously with minimum repair costs.

4. FLEXIBILITY—the ability to follow the steam demand upward or downward . . . quickly and without sacrificing efficiency.

5. EFFICIENCY—the proved dollar efficiency (total cost of steam production) as shown by actual performance in similar installations.

6. OPERATION—the ability to operate continuously, the number and type of operations required, the ease of combustion adjustments, etc.

7. ADAPTABILITY—the ability to meet special and limiting conditions, present and future—structural limitations, utilization of present equipment, growth and change of power service demands.

8. FUEL FLEXIBILITY—the ability to burn efficiently and easily fuels from many sources having widely varying characteristics.

9. REFUSE DISPOSAL—the ability to economically eliminate ash or refuse and the opportunities of disposal at low cost, no cost, or profit.

10. STACK DISCHARGE—the practical elimination of "smoke nuisance" without special equipment.

11. SPACE REQUIREMENTS—the ability to conform to existing or future space limitations, to short and wide or long and narrow furnaces. Also the accessibility of component parts for maintenance and operation.

12. OBSOLESCENCE—the adaptability of the equipment toward possible future modernization with minimum of complication and outage.

A-E-CO TAYLOR STOKERS • LO-HED HOISTS
HELE-SHAW FLUID POWER • MARINE DECK AUXILIARIES

A-E-CO TAYLOR STOKER

AE CO

AMERICAN ENGINEERING COMPANY

PHILADELPHIA 25 • PENNSYLVANIA

INSTALLATION TIME AND EXPENSE

Gearmotors can be installed easily and quickly . . . with definite savings in time, trouble and expense. Once out of the crate, they're mounted and in operation with a minimum of time lost.

No other type of speed reduction is as simple to put into operation . . . because a gearmotor combines motor and speed reducer in *one* compact, easy-to-handle unit. It mounts on a single foundation, or directly on the machine to be driven, with no more expense than mounting a single motor. No complicated figuring is required . . . no time-consuming aligning and adjusting of many separate units.

Gearmotor installations save time because there are no belts, pulleys, open gears, guards or other pieces of equipment to be mounted or aligned separately. A recent typical installation of a splashproof gearmotor on a grain unloader saved $200 because the gearmotor made the housing and countershaft unnecessary.

Ask your Westinghouse representative about this and the many other basic advantages of gearmotors. All of these are discussed in detail in a new handbook, "Gearmotor Applications". Ask for B-3218. Westinghouse Electric & Mfg. Co., P.O. Box 868, Pittsburgh 30, Pa.

J-07223

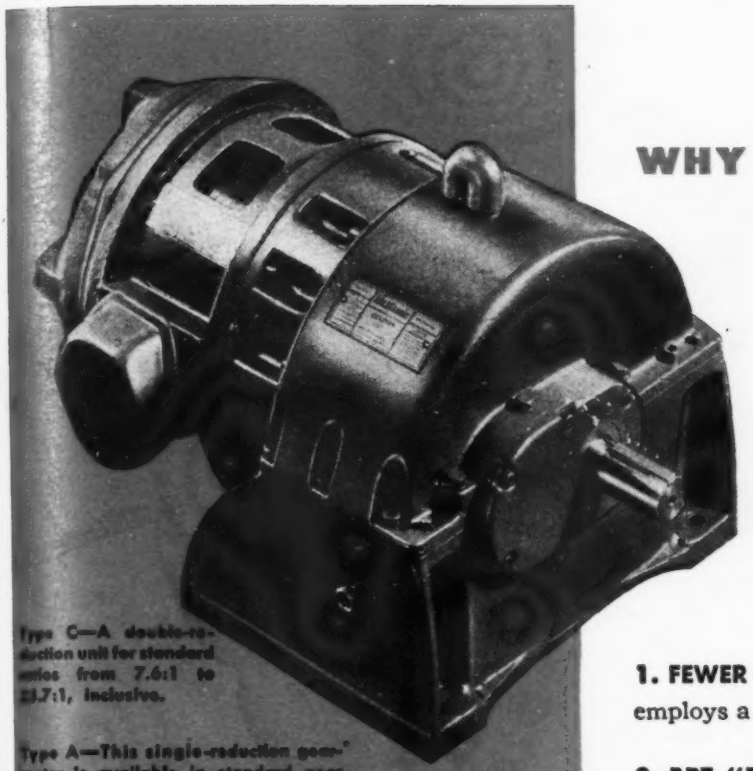
REASON NO. 1—GEARMOTORS SAVE SPACE

REASON NO. 2—GEARMOTORS SIMPLIFY SELECTION, ORDERING, DELIVERY

One of a series sponsored by Westinghouse to promote the use of gearmotors

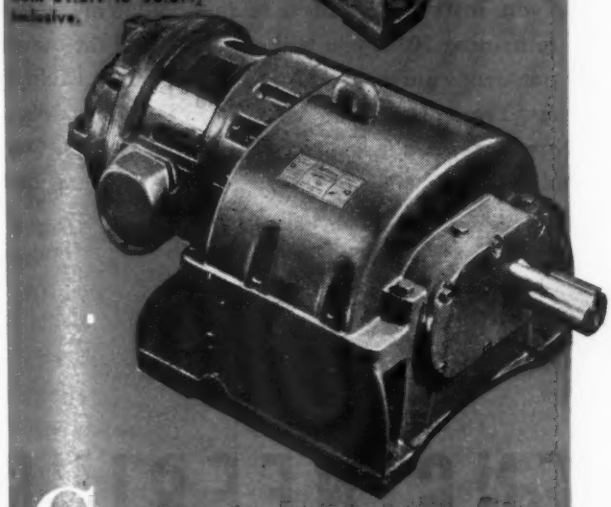
Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE



Type C—A double-reduction unit for standard ratios from 7.6:1 to 23.7:1, inclusive.

Type A—This single-reduction gearmotor is available in standard gear ratios from 1.22:1 to 6.25:1, inclusive.



Type E—Double-reduction gearmotor available in standard ratios from 31.2:1 to 58.3:1, inclusive.

Gearmotors

WHY INSTALL WESTINGHOUSE GEARMOTORS?

. . . here are 10 good reasons

1. FEWER PARTS TO WEAR. The simple, efficient, design employs a minimum of moving parts.

2. BPT "TOUGH-HARD" GEARS AND PINIONS. This exclusive Westinghouse heat-treating method "tough-hardens" teeth for maximum resistance to shock and impact—means longer wear.

3. USE ALL WESTINGHOUSE MOTOR TYPES—open . . . totally-enclosed . . . splashproof . . . explosion-proof—to meet changes in operating conditions quickly and easily.

4. INTERCHANGEABILITY OF PARTS between unit types reduces your parts' replacement stock by 40%.

5. HIGH EFFICIENCY of gearing parts assures full motor horsepower at output shaft . . . only 2% power loss for each gear set.

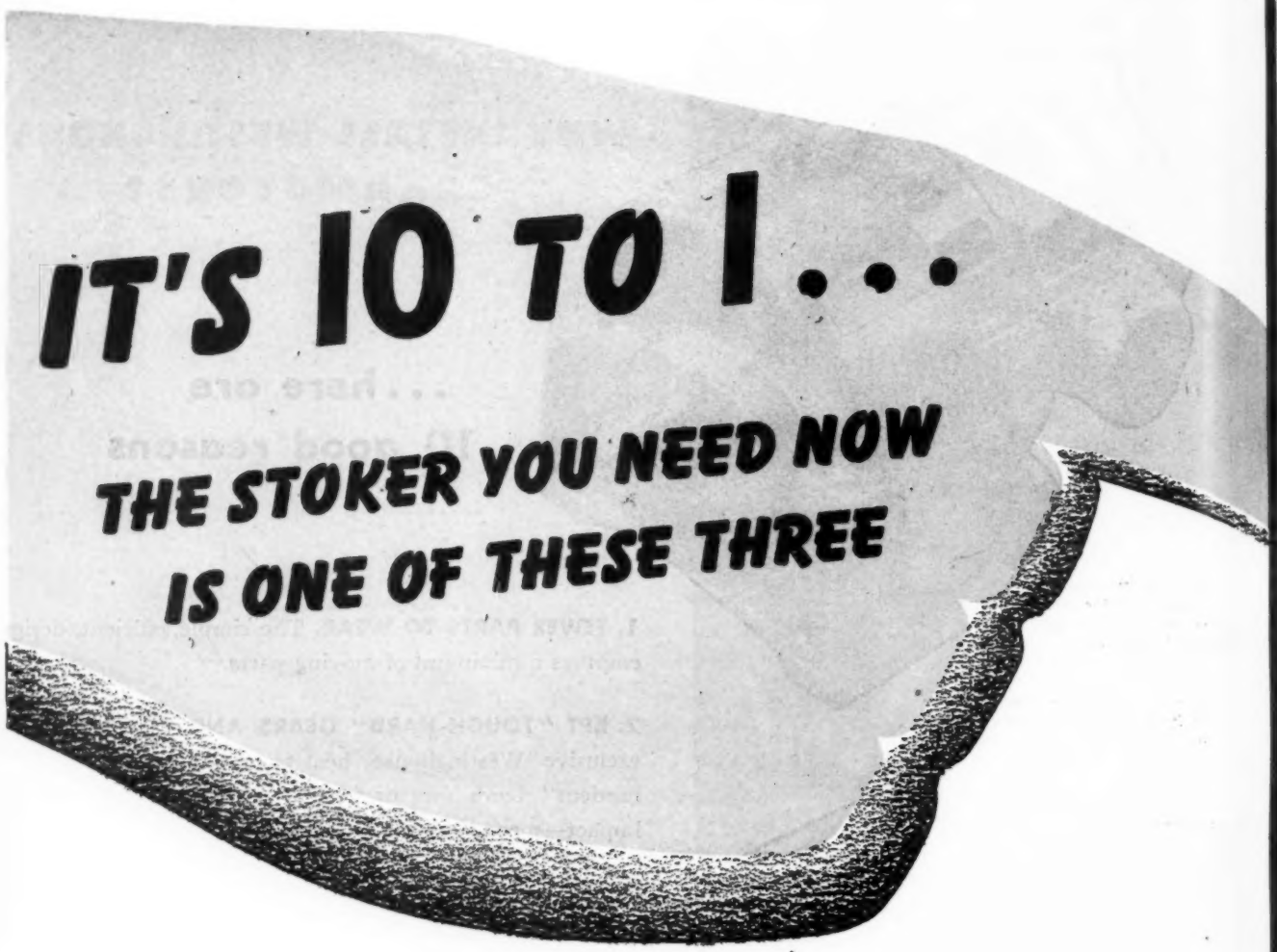
6. POSITIVE LUBRICATION of gears and bearings by automatic splash system reduces probable maintenance to twice-a-year change of oil.

7. EASY ACCESSIBILITY. Gearing parts can be readily inspected or easily removed to make gear ratio changes.

8. IMPROVED FOUNDATION STABILITY. Feet are under the gear case . . . placing support next to the gearmotor load. Each foot is reinforced by external ribs.

9. UNIT RESPONSIBILITY for design . . . manufacture . . . and service. Westinghouse builds both motor and the gears.

10. MEET A.G.M.A. STANDARDS. Westinghouse Gearmotors are specifically designed and built to meet A.G.M.A. standards . . . easy to order and match to the job.



HERE are three stoker designs — each developed to meet a different combination of requirements — which have demonstrated through actual survey, their complete suitability for 90% of all installations covered by C-E contracts of recent years.

These three simplify for you the problem of stoker selection to one of merely determining which type is the answer to your conditions of steam load, boiler design, and available fuels. With that done, you can be sure of reliable performance, durability, and low maintenance by entrusting your requirements to C-E. For embodied in each of these three designs are all the "know how" and experience gained from the installation of over 18,000 stokers of every type, above residence size, to serve approximately 5,000,000 rated boiler horse power.

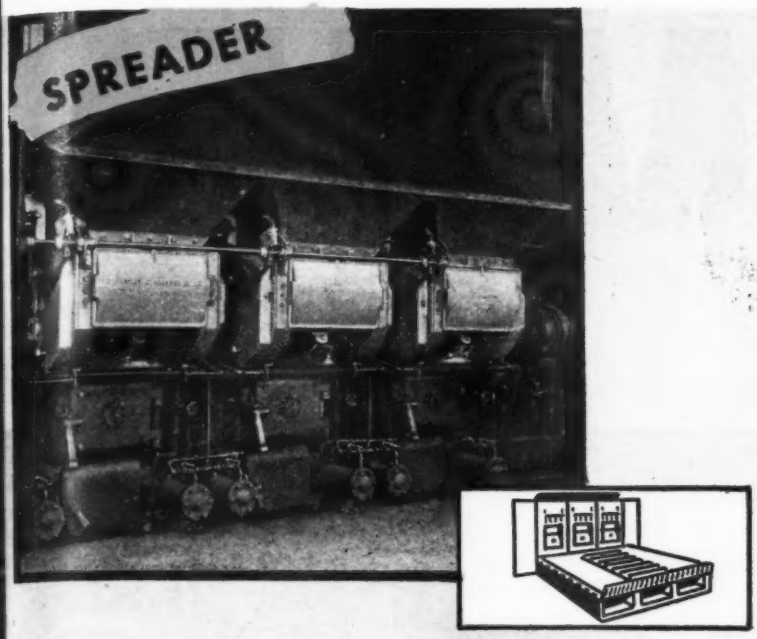
Comprehensive as these three types are, the C-E line includes other designs which round out the most complete line of stokers offered by anybody anywhere. So if your installation falls outside the 90% and within the remaining 10%, you will certainly find the answer to your needs among modern C-E designs of Multiple Retort, Travelling Grate, and Chain Grate Stokers.

Now is none too soon to plan for your new post-war installation or needed replacements. A C-E engineer will be glad to discuss your problem with you. A-829

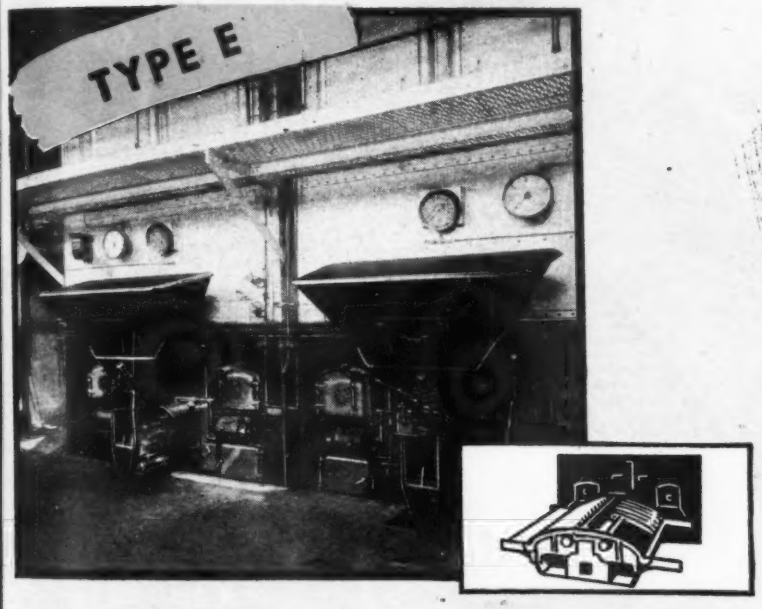
COMBUSTION ENGINEERING

200 MADISON AVENUE · NEW YORK 16, N. Y.

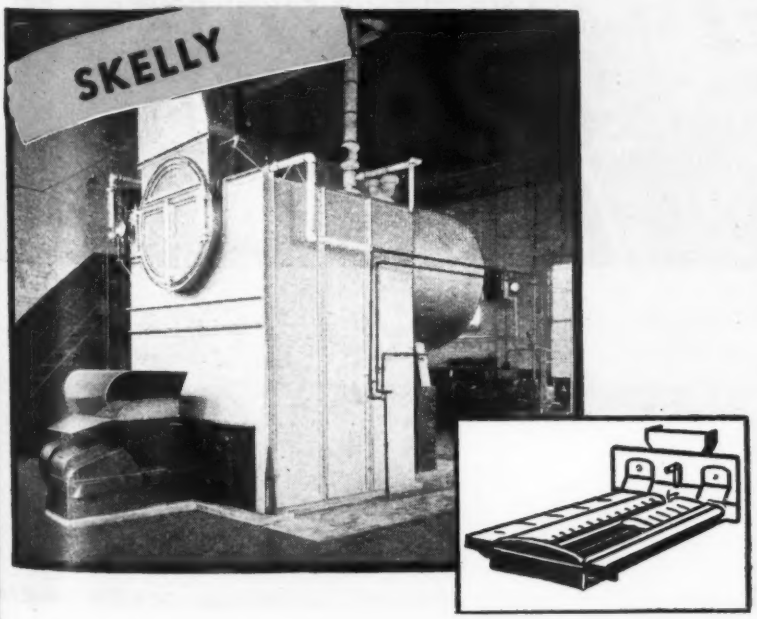
C-E PRODUCTS INCLUDE ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS



Approximate Application Range — 150 boiler hp to largest units suitable for stoker firing. A simple, rugged stoker designed to burn a wider variety of fuels than any other type of mechanical firing. Hopper, feeding and distributing mechanism, variable-speed drive and motor are combined in a compact unit. Rotating spreader blades feed coal into the furnace in crisscrossing streams which assure uniform distribution. Fines are burned in suspension and the rest of the coal is burned on a grate — stationary or dumping type. Grate surface is zoned for regulating air admission and to facilitate cleaning.



Approximate Application Range — 150 to 600 boiler hp. A single-retort, underfeed stoker designed to burn a wide variety of bituminous coals. Ram feed is supplemented by a reciprocating sliding bottom. Grate surface consists of hollow, air-cooled grate bars, alternately fixed and moving, to condition the fuel bed and assure its steady movement toward the dump trays. Air supply under zoned control with provision for introducing air over the fire. Steam or hydraulic drive.



Approximate Application Range — 20 to 200 boiler hp. A compact, self-contained unit offering all the advantages of underfeed firing. Moving grate bars assure lateral distribution of fuel and maintain a clean porous fire. Cantilever dump grates of non-avalanching type simplify ash removal. Integral forced-draft fan, with vortex inlet control, permits positive regulation of air-coal ratio. Sixteen rates of coal feed through variable-speed transmission. Automatic control is standard equipment. Timken bearing equipped. Alemite lubrication throughout.

POWER

TEXACO

TEXACO

TUNE IN THE TEXACO STAR THEATRE EVERY SUNDAY NIGHT — CBS

for a War of Movement

STORED on spur tracks along a main rail line, locomotives by the hundred await use in liberated territory . . . their dependable power a guarantee of rapid movement of supplies for our fighting men.

In steam locomotives, as in all types of steam generating plants, effective lubrication is a "must" for continuous, full-power output. That's why, when plant engineers order lubricants today, so many of them specify Texaco.

Whatever the steam temperature or pressure, in engines old or new, there is a Texaco steam cylinder oil that will atomize completely, adhere to cylinder walls, separate rapidly from exhaust; assure quiet operation and low oil consumption.

Texaco lubricants have proved so effective in service they are definitely preferred in many fields, a few of which are listed below.

Texaco Lubrication Engineering Service is available to you through more than 2300 Texaco distributing points in the 48 States. The Texas Company, 135 East 42nd Street, New York 17, N. Y.

THEY • PREFER TEXACO

★ More revenue airline miles in the U. S. are flown with Texaco than with any other brand.

★ More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.

★ More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

★ More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

★ More locomotives and railroad cars in the U. S. are lubricated with Texaco than with any other brand.

STEAM CYLINDER OILS

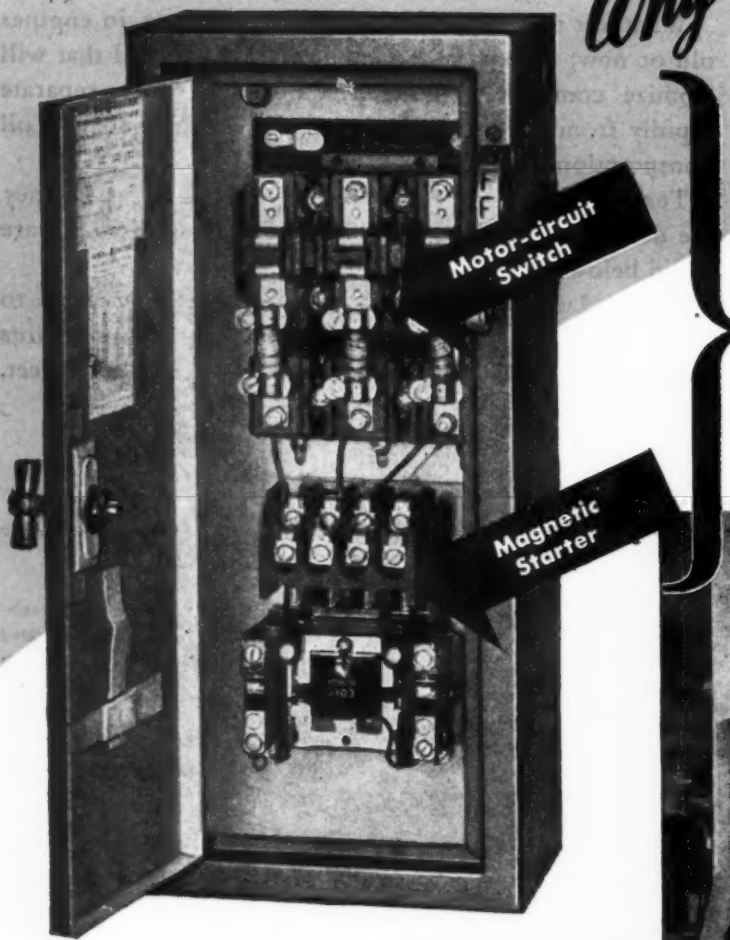
FOR EVERY STEAM CONDITION

HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

You can save time and space

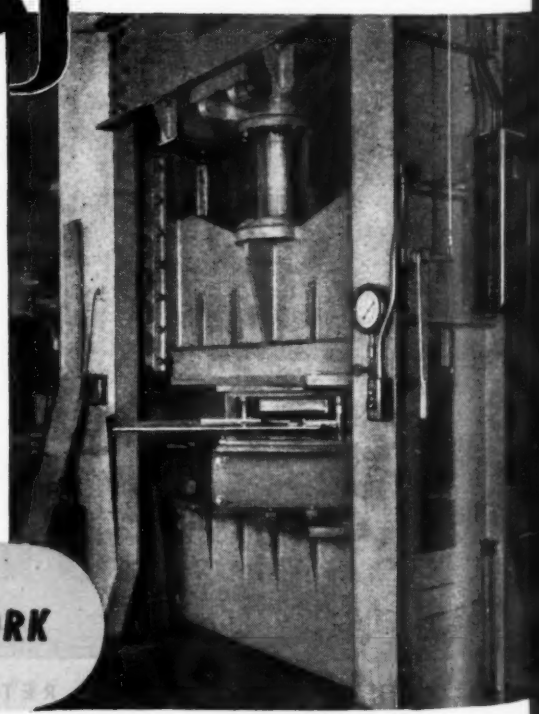
ONE COMPACT

Why two devices? ONE



GE

COMBINATION STARTER



Combination starter and push-button station on a press

G-E COMBINATION STARTERS AT WORK

...gain greater protection too

...UNIT

FOR MOTOR CONTROL AND PROTECTION

...can do the job.

YOU no longer need buy a separate device for each function of motor control. Now you can get *combination* control—in a *variety of enclosures* to meet every operating condition. This control combines a motor-circuit switch and a magnetic starter in one, compact, easy-to-mount unit.

By using these starters you profit five ways:

1. Quick Selection—By ordering *one* factory co-ordinated unit instead of two, you can save time. You just specify the motor rating and indicate the type of motor-circuit switch you want and the type of application you have in mind—we'll send you the starter you need.

2. Reduced Installation Time—Users of combination starters report a 50 per-cent reduction in mounting time and a 40 per-cent reduction in wiring time.

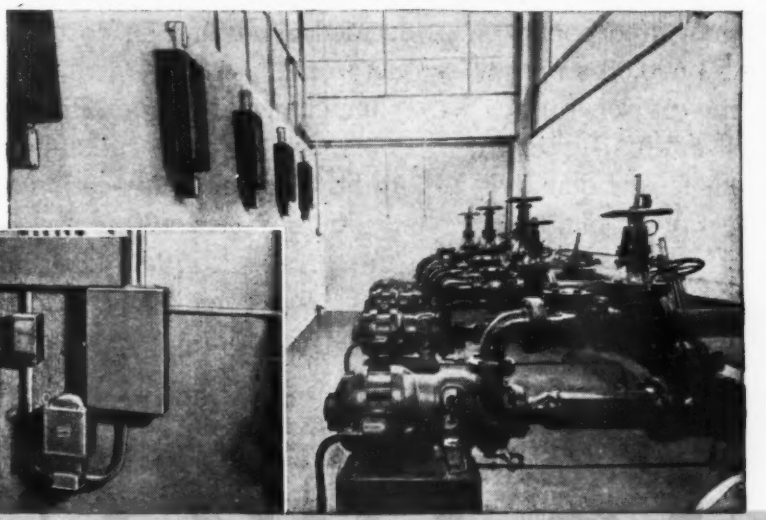
3. Motor Protection—With G-E combination starters, you're sure that the rating of the motor-circuit switch or breaker matches that of the magnetic starter with which it is to be used. The co-ordination of thermal overload relays with the fuses or breakers affords complete motor overcurrent protection under any condition of operation.

4. Greater Safety—The motor-circuit switch, being in the same case with the magnetic starter, is mechanically interlocked with the cover. Thus the cover cannot be opened while there is power on the starter.

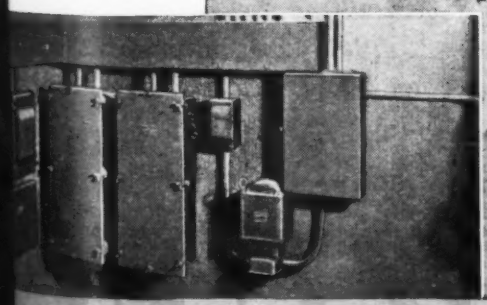
5. Less Space Required—Combination starters take less mounting space than separately mounted safety switches and starters.

These starters are also available for high-voltage starting. For further information on combination starters write to your local office for Bulletin GEA-3715. *General Electric Company, Schenectady 5, New York.*

Combination starters (on wall at left) installed in a pump room



For reliability of operation, combination starters with dust-tight enclosures in a grain elevator



Every week 192,000 G-E employees purchase more than a million dollars' worth of War Bonds

GENERAL ELECTRIC

IRON FIREMAN cuts Steam Costs 33%

After installation of Iron Fireman Stokers at BEST FOODS, Inc. steam costs dropped from 36.06¢ to 24.25¢ per 1000 pounds

BEST FOODS, INC., of Chicago, cut fuel costs one-third after installing Iron Fireman Pneumatic Spreader stokers. In actual figures, the cost for the first three months of 1943 was $14,446.71. For the same period of 1944 the cost of Iron Fireman fired coal was $9,543.91, a saving of over $1,600.00 a month for approximately the same power output. Iron Fireman maintains a steady, even steam pressure, even though steam demands for processing in the Best Foods plant are extremely variable.

Operating economy of Iron Fireman Pneumatic Spreader stokers is due to two factors: (1) The Iron Fireman Volumeter keeps the vital fuel-air ratio under constant automatic control, resulting in high combustion efficiency; (2) Ability to use a very wide range of coals, including sub-bituminous and lignite, gives a decided advantage in cost and availability of fuel to the user.

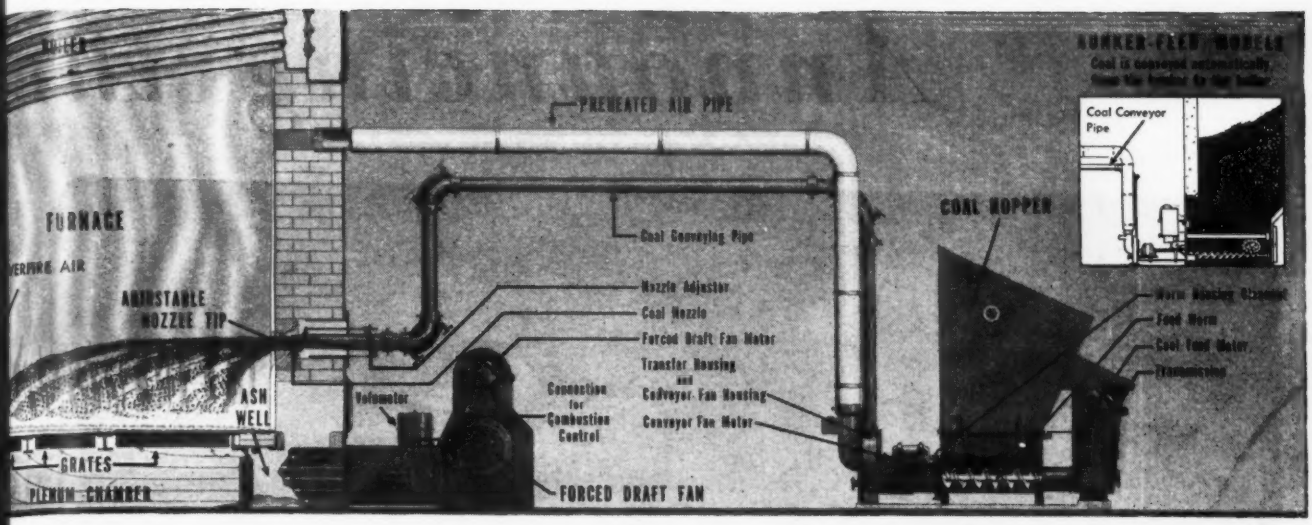
The unusual adaptability of Iron Fireman Pneumatic Spreader stokers yield further economies. Coal pick-up sections may be located anywhere within a 30-foot radius of the boiler front, or on another floor level. This saves labor, and often avoids a heavy investment in coal handling equipment.

Plants: PORTLAND, OREGON; CLEVELAND, OHIO; TORONTO, CANADA

IRON FIREMAN

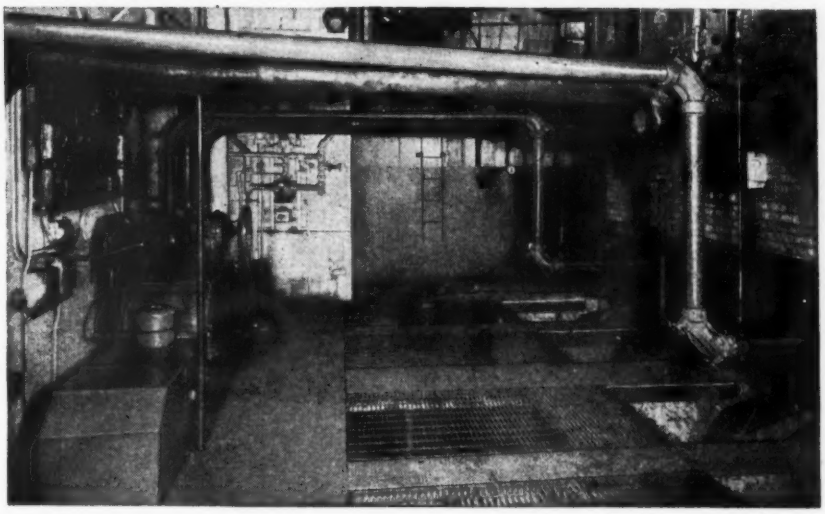
THE IRON FIREMAN

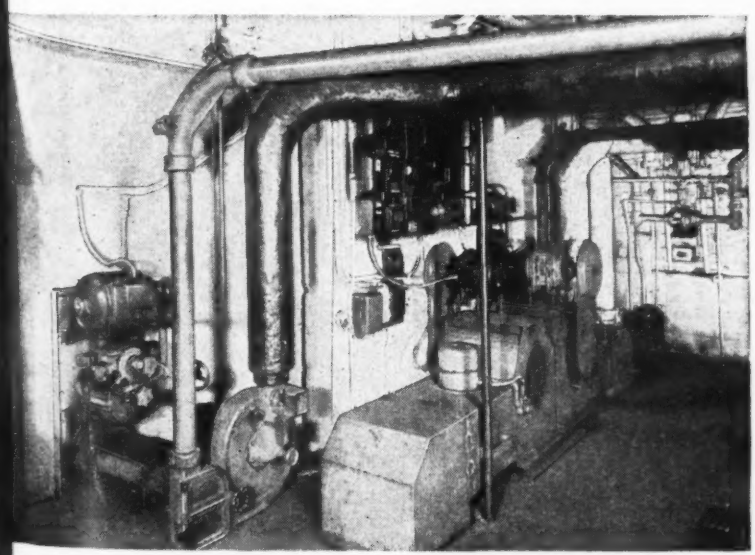
Automatic Coal Stoker



THE IRON FIREMAN PNEUMATIC SPREADER STOKER

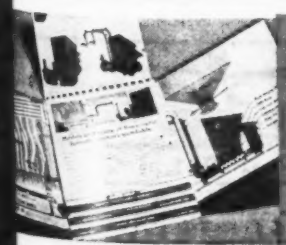
The principle of the Iron Fireman Pneumatic Spreader stoker is illustrated above. Steam size coal is metered from the hopper or main coal bunker to transfer housing, where coal is picked up by pneumatic conveyor and delivered to furnace. The conveyor nozzle accurately spreads the larger particles of coal over the entire grate in a shallow, uniform fuel bed. The preheated fines burn in suspension, reducing the cinder carry-over and greatly improving the combustion efficiency and responsiveness, as compared with other stokers which do not preheat the fuel.





BOILER ROOM IN CHICAGO PLANT OF BEST FOODS, INC.

Uncluttered boiler fronts, typical of Iron Fireman Pneumatic Spreader installations are shown above. The coal conveying pipes pass overhead, descending to the nozzle level in front of the boilers. The insulated pipe seen in both photographs is the preheated air pipe which withdraws hot gases from the upper part of the furnace for preheating the fuel. The coal pick-up sections (photo at left) feed directly from the main coal bunkers. Also visible are the forced draft fans, which in this installation are connected to the plenum chamber through underfloor ducts.

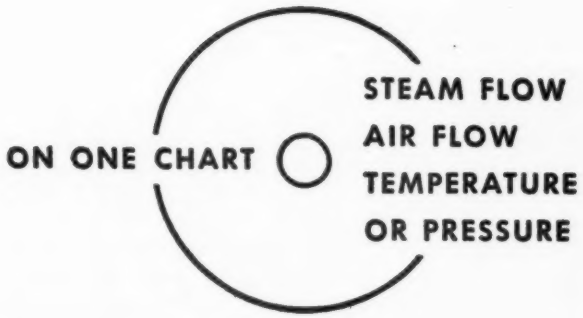


ENGINEERED INSTALLATIONS. Iron Fireman maintains a highly competent engineering staff manned by combustion engineers of long practical experience. Every Iron Fireman installation is engineered to achieve the highest possible efficiency for that particular job. Write to IRON FIREMAN MANUFACTURING COMPANY, 3274 West 106th Street, Cleveland, Ohio, for free book on Pneumatic Spreader firing. Upon request, Iron Fireman will make an engineering survey of your boiler room without obligation.

Announcing the

REPUBLIC
INSTRUMENTS
AND CONTROLS

Republic Boiler Meter



● The new Republic Boiler Meter provides, in one instrument and on one chart, all the essential information concerning boiler performance regardless of the size or type of boiler, kind of fuel or method of firing.

The meter indicates, records, and integrates steam flow from the boiler and records rate of air flow for combustion. When the correct amount of air for maximum combustion efficiency is being supplied the air flow pen will record coincident with the steam flow pen, regardless of the load being carried by the boiler.

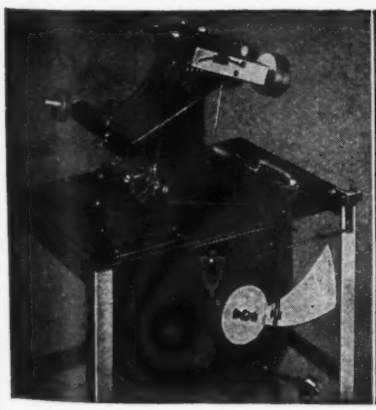
A third pen recording flue gas temperature (or steam pressure) can be added thereby providing the operator with complete information, on one 12-inch chart, relative to the performance of the boiler at any given time.

The Republic Boiler Meter is primarily a boiler operating guide. The two records, steam flow in red and relative air flow in blue, tell the operator instantly whether correct combustion and furnace conditions exist, thereby enabling him to correct faulty conditions when they occur.

The Republic Boiler Meter consists of a standard Republic electric steam flow recorder and integrator and an oil sealed, bell type air flow element.

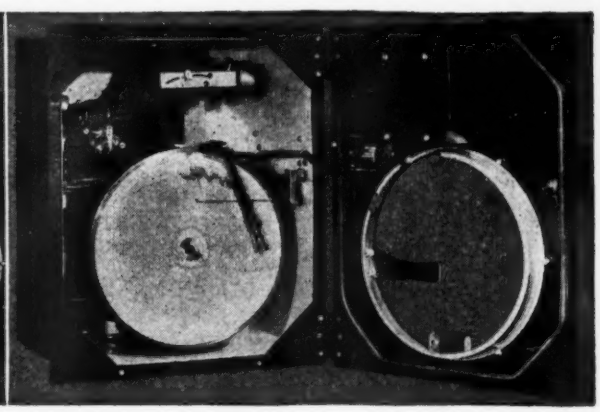
The air flow element consists of an oil sealed bell in a sealed chamber. The motion of the bell is transmitted through a diaphragm seal. This arrangement permits the use of a single bell—the high pressure being applied to the top of the bell and the low pressure under the bell. This arrangement also excludes air and dirt from the oil. The motion of the bell is transmitted to a cam system which extracts the square root, or when adjusted for a particular installation, compensates for chimney action and variable excess air requirements. The air flow pen is attached to the cam system with an adjustable linkage which permits changing the steam flow air flow ratio as conditions may require.

The entire operating mechanism is housed in a rugged steel case and can be easily removed as a single unit by merely loosening two anchor bolts and disconnecting the two air connections. The meter may be either wall mounted or flush mounted on a steel panel. *Write for Bulletin No. 420.*



Meter assembled as one unit on rack ready for calibration.

Meter assembly can be easily removed from the case.



Meter with door open showing accessibility of all adjustments and working parts.

Republic Flow Meters Co.

2222 Diversey Parkway · Chicago 47, Illinois

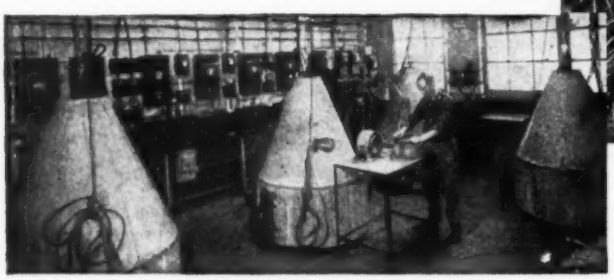
DOSE OF SALT

Encrusted with chemical salts, this Tri-Clad motor continues to drive a pump without breakdown of its insulation. In almost every industrial plant, motors are called upon to keep going under conditions which try their endurance to the limit. It may be in a plating room, or on an exhaust fan, or in a wet sub-cellar, or — as in this case — in connection with chemical processing. In emergencies, open motors may face conditions for which good engineering practice would require totally enclosed construction — conditions which tend to corrode the frame and attack the insulation. Endurance of Tri-Clad motors under such conditions results from tests like the one described below.

Salt-spray test of TRI CLAD motors gives assurance of long life in severe service

IN this accelerated life test to determine the ultimate endurance of their insulation, the motors are operated to failure under one of the worst possible combinations of conditions. They are continually exposed to a 2% salt-water spray, while operating on a duty cycle of 3 minutes on and 37 minutes off. (These repeated voltage surges impose greater stress on the insulation than would continuous operation.) Tests are run on all new insulations developed, and as a production check on motors taken at random off the assembly lines. Because of their endurance under this severe test, among others, Formex* wire and Glyptal* bonding material were chosen for Tri-Clad insulation.

*Reg. U.S. Pat. Off.



Left: Conical hoods cover the tanks in which these salt-spray tests are conducted.

GENERAL ELECTRIC

Every week 192,000 G-E employees purchase more than a million dollars' worth of War Bonds.

OFTEN

This

is the Practical Way To Elevate Coal

Demonstrating That There's No Single Solution to All Coal Handling Problems

What is the best way to handle coal at a power plant—belt conveyor, bucket elevator, enclosed conveyor-elevator, skip hoist?

In the case shown, the skip hoist does the bulk of the work. Its selection as the most practical of the many types of elevating equipment available was based on a thorough study of all the problems involved at this specific plant. As a result, coal is being handled rapidly at low cost per ton.

What this example emphasizes is the fact that each handling problem calls for a specific answer. That's the reason you are urged to lay your problems before a competent, unbiased jury of experts—the S-A engineering staff. With access to *all* types of conveying and elevating equipment (all made by S-A), they are in a position to recommend the exact system you need for utmost handling efficiency. Write us today for the whole S-A story.

This photo shows a power plant, coal handling system consisting of a double bucket skip hoist, a pan feeder and belt conveyor, all of which were furnished by Stephens-Adamson.

STEPHENS-ADAMSON MFG. CO.

5 RIDGEWAY AVENUE, AURORA, ILLINOIS — LOS ANGELES, CALIF. ★ BELLEVILLE, ONT.

Designers and Manufacturers of All Types of

BULK MATERIAL HANDLING EQUIPMENT

Scovill Tube News

Vol. 2 SCOVILL MANUFACTURING COMPANY, Waterbury 91, Conn. No. 7

Corrosion and Protection

Scovill Engineers Continue a Discussion of Condenser and Heat Exchanger Tube Corrosion

The following information, selected from Scovill's new "Condenser Tube Booklet", follows a description of Types of Tube Corrosion which appeared recently in this space.

STRESS CORROSION CRACKING

The following definitions, taken from A. S. T. M. Specification B154-41T cover the types of cracking which are classified under the above headings:

(a) *Stress Corrosion Crack:* A crack due to the simultaneous action of externally applied tensile stress and certain specific corrosive media (usually ammonia plus moisture). This type crack occurs with little or no deformation of adjacent metal.

(b) *Season Crack:* A crack due to the simultaneous action of residual tensile stress and certain specific corrosive media (usually ammonia plus moisture). This type crack occurs with little or no deformation of adjacent metal.

(c) *Applied Stress:* An external stress due to a force from without the mass of the unit part and usually the result of assembly operations. Welding shall be considered as assembly operation.

(d) *Residual Stress:* An internal stress inherent in the mass of a body in its unit form (not an assembled unit), usually as a result of cold working.

It is evident from the above information that stress-corrosion cracking or season cracking of certain copper alloys is due to (1) stress and (2) corrosion by specific reagents. Cracking of this type is usually confined to alloys of Copper and Zinc containing less than 85% copper. Unless otherwise specified, condenser tubes are finish annealed and are not in a condition to season crack during storage or service. Most specifications covering tubes require a mercurous-nitrate test on samples from each lot of tubing as an insurance against season cracking of the tubes in service.

CORROSION-FATIGUE CRACKING

Fatigue of metals is the action which takes place in metal parts which are subjected to repeated stress during their service life. Failure of metals by fatigue cracking occurs at stresses well below the static ultimate strength. Fatigue failures are characterized by suddenness and by the absence of general deformation of the piece which failed. Condenser and heat exchanger tubes which are subjected to considerable vibration or other cyclic stresses in service may fail as a result of fatigue or corrosion fatigue. Corrosion of the metal lowers its fatigue resistance so that corrosion, acting simultaneously with fatigue stresses, often leads to premature or accelerated cracking. It is also interesting to note in this connection that repeated stressing of metals may accelerate corrosion; it is probable that the cyclic stresses acting on the metal cause cracking of the protective film at highly stressed areas, exposing fresh metal surfaces to corrosion; this action, in turn, would increase stress concentration at such stressed and corroded areas and might result in early fatigue cracking and failure.

EFFECT OF SERVICE CONDITIONS

It is always good practice to place Condenser Tubes in service under conditions most favorable for the formation of protective and continuous films on their surfaces. There is sometimes no choice in this matter but, in other cases, advantage can be taken of favorable operating conditions for the initial service of the tubes. As an example, it has already been pointed out that temperature is an important factor in corrosion; it is evident, therefore, that new tubes which are placed into service during the winter months when water and atmospheric temperatures are low, should have a better opportunity for building up a protective film over their surfaces than tubes which are installed and started in service during the warmer months of the year. Again, water supplies, in some cases, are known to be more corrosive during certain particular seasons and, for this reason, the placing of new tubes in service during such periods should be avoided if possible. In the case of ship condensers, Bengough (I. Inst. Metals, Vol. XXVL — page 433) has called attention to the fact that tubes are most sensitive to adverse conditions when newly placed in a condenser and should not be exposed to waters known to be dangerous during their early life. This precaution could not be followed generally but could be considered in some cases as, for instance, when a choice might be made between ports where ships could be docked for retubing; in such cases it would be advisable to choose the location where least contamination of the water by industrial wastes, sewage, etc. is experienced.

SUGGESTED METHODS OF TUBE PROTECTION

Electrolytic or Electro-Chemical Method

Processes have been developed and used for the protection of tubes in a heat exchanger by the use of an external electric current applied in such a way that the tubes are cathodic. Anodes usually consist of blocks of cast iron inserted in the spaces at either end of the condenser. Current of the order of 0.02 amperes per square foot of tube surface is passed through the system. In some cases good results have been reported for this process but in other cases little or no benefit has been gained by its use. Where corrosion of condenser tubes has seemingly been retarded by this method, it has been suggested that iron compounds, formed at the anode of the system, are precipitated on condenser tube surfaces and form protective films; if this is the case, anodic corrosion rather than cathodic protection retarded tube corrosion. The use of zinc plates or blocks, galvanically coupled with tubes, is a practice somewhat analogous to the electrolytic method of protection although in this case a very low E.M.F. is generated by the zinc-brass couple. Re-

sults obtained by this method have been disappointing as a whole. Here again improvement in condenser tube life may be noted in some installations but this may be due not so much to cathodic protection as to the introduction of zinc compounds into the circulating media and their subsequent deposition on the tube surfaces as a protective film.

TINNING OF BRASS CONDENSER TUBES

Under certain service conditions, a tin coating on brass condenser tubes has materially extended the life of the tubes. The protection which is obtained by such a coating would depend on (1) its thickness and (2) on the type of deposit, i.e., whether continuous and free from pores, pits, etc. When the tin is removed at any area as a result of abrasion, corrosion, etc., or when the coating is porous or discontinuous, accelerated corrosion of an electro-chemical nature may take place at exposed areas, the coating of tin then acting as an accelerative rather than as a retarding agent to the corrosion of the brass. The use of tin coated tubes at the present time is confined more or less to special applications where tin is known to have excellent corrosion-resistant properties.

PAINTING OF TUBES AND TUBE ENDS

The application of certain bituminous or other suitable paints or cements to tube surfaces has had extensive use as a protection against corrosion. Painting is usually limited to tube ends which have corroded as a result of impingement attack but occasionally paints have been applied to the entire interior or exterior tube surface. The paint may be either brushed or sprayed. Before application, however, the tube surfaces must be thoroughly cleaned and dried as, otherwise, the paint would not adhere properly and might blister and peel. Painting of the entire tube would decrease the thermal conductivity materially and would, therefore, reduce the efficiency of the unit; painting of the tube ends, however, has a negligible effect in heat transfer. In cases of severe "end corrosion" of tubes, paint would have to be applied periodically for the most satisfactory results. There have been many reports in the literature of the beneficial effect of painting of tubes even after the tubes have shown serious corrosion.

USE OF METAL OR PLASTIC INSERTS

Metal inserts and, more recently, inserts of plastic composition, have been used very successfully to protect tube ends against corrosion. For best results, these inserts should fit snugly and should preferably be held in place by a cement so that they do not become loose and fall out of the tubes. They should also be tapered so that no appreciable shoulder exists at the end of the insert inside of the tubes. The inserts should not protrude into the water boxes but should preferably have a flared end which would fit reasonably close against the tube sheet: this precaution is necessary to avoid turbulence of the water. The use of inserts is usually limited to installations where tubes show definite evidence of severe inlet end corrosion and, in this application, they have proven to be economical in extending tube life.

FURTHER INFORMATION IN FREE BOOKLET

The Scovill "Condenser Tube Booklet" serves to bring into the hands of condenser and heat exchanger tube users the accumulated experience of Scovill engineers who have specialized in this field. Readers can find valuable information on such subjects as:

Tube Corrosion: types (with characteristic specimens illustrated in natural color), causes and methods of protection

Selection of Tube Material

Composition and Properties of Tube Alloys and Common Metals

Installation Methods

Specifications

Methods of Production

Also included are such useful data tables as those on gauge sizes, conversion factors, formulas and physical constants, etc.

THIS IS ONE OF THREE SCOVILL SERVICES YOU CAN USE

The information contained in the "Condenser Tube Booklet" is illustrative of Scovill's *Service in Manuals*, through which Scovill's specialized knowledge is shared with its customers. *Service in Metals* covers the development of new alloys and the prescription of specific metals for individual conditions. *Service in Men* is the on-the-spot recommendations rendered by Scovill engineers who will assist on new installations to help you obtain maximum efficiency or will investigate trouble cases to locate the source and suggest the cure. When you think of condenser tubes, think of Scovill's *Three Services*.

For free copy of Scovill "Condenser Tube Booklet", write Scovill Manufacturing Company 13 Mill St., Waterbury 91, Conn.

THIS IS NUMBER THIRTEEN in a Series of Scovill Advertisements to help you get longer life from condenser and heat exchanger tubes.

Scovill
MANUFACTURING COMPANY
WATERBURY, CONN.

SCOVILL CONDENSER TUBES

ONE PRODUCT... THREE SERVICES

Service in Manuals... Service in Metals... Service in Men

then he thought to himself

"WHY WAIT 'TIL YOU'RE CORNERED?"

AT his recent reception in Washington, General DeGaulle and General Pershing were deploring the havoc of the war and hoping some good might result. DeGaulle remarked that perhaps Mahomet had something when he ventured the statement:

> *"Without war, the world would be in a condition of stagnation."*

It is a sad commentary on human inertia that men must wait until the gun is jabbed in their ribs before they will stir themselves to great effort.

But it seems a fact that men usually wait for a crisis before they get bold and take hurried recourse to the best means for liberation.

Even today, some business men are waiting for the pointed guns of competition before taking action. And others . . .

WHY WAIT 'TIL YOU'RE CORNERED?" *he says*

LOOK, GENERAL, how some are beating the gun of competition through recourse to this Lincoln Arc Welding equipment:

Gun Beater: THE NEW LOW-COST "SHIELD-ARC" WELDER

A dependable, versatile engine driven welder for shop or field use . . . for fabrication, construction or maintenance welding applications of all kinds.

"Job Selector" provides *known* TYPE of welding arc to match every job and same adjustment sets engine speed at proper minimum rate.

Rated 200-Amps. Capacity for heavy overload when required.

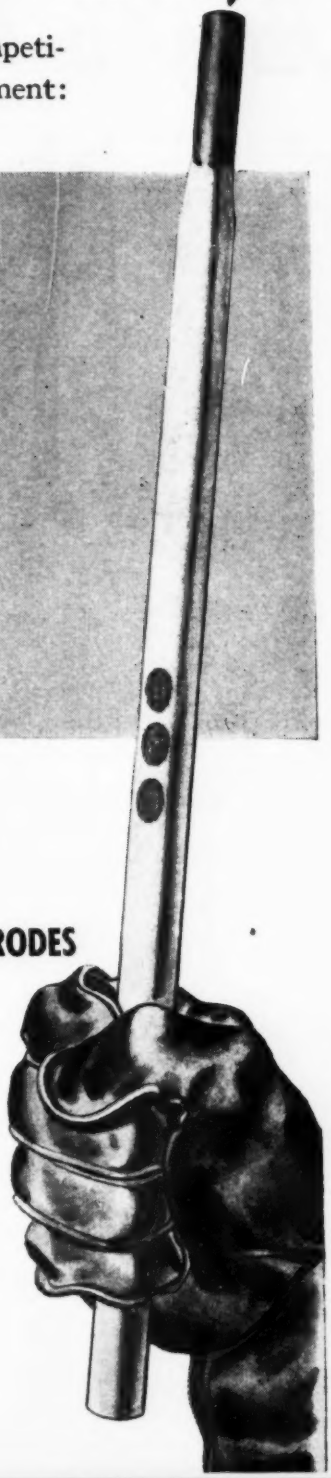
Full details in Bul. 312-C.

Gun Beaters: LINCOLN ELECTRODES

35 types for every essential welding requirement . . . for mild steel (world-famous "Fleetweld") . . . for alloy steels . . . for non-ferrous metals . . . for hard-facing . . . for cast iron.

Look for the 3 dots . . . the sign of genuine Lincoln Electrodes.

Full details and procedures in "Weldirectory," Bul. 402. Free on request.

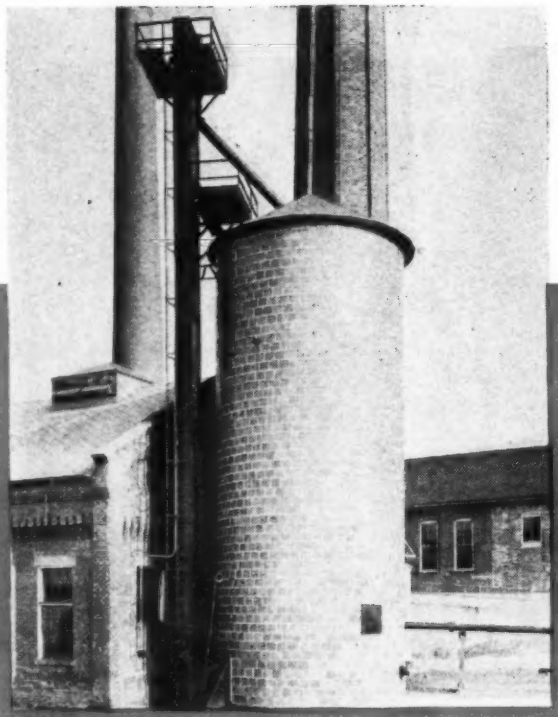


THE LINCOLN ELECTRIC COMPANY • CLEVELAND 1, OHIO

America's greatest natural **recourse**

ARC WELDING

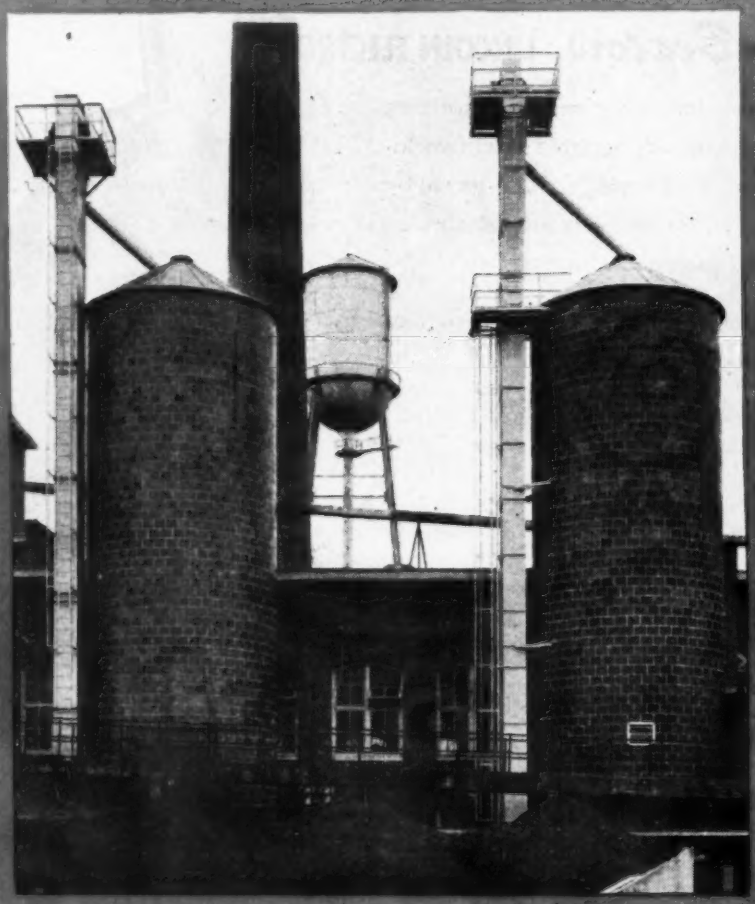
There's a FAIRFIELD SILO



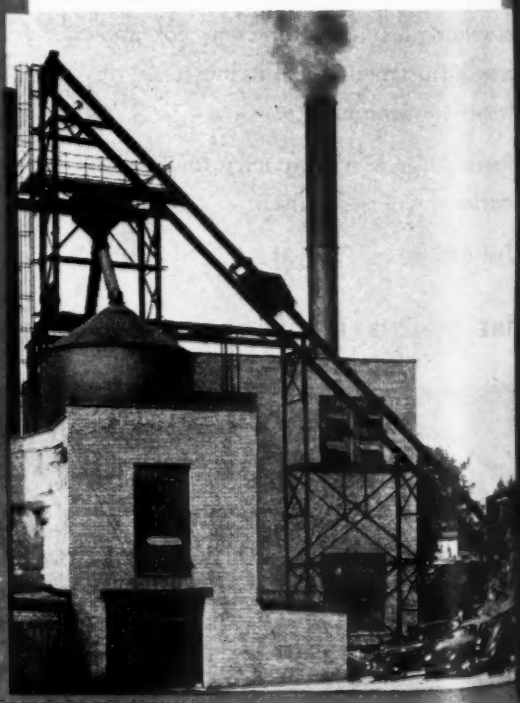
● To meet the specific needs of your plant for efficient, clean, automatic coal and ash handling FAIRFIELD offers its vitrified tile silo and handling systems.

This system can be furnished with a single silo — two silos — bucket elevator or skip hoist and a conveyor or weigh larry for distribution according to your needs. With any of these the coal is handled automatically from car to storage to stoker or pulverizer.

The location of the silo outside the building and the fully dust proof distributing system makes for a clean boiler room. The vitrified tile silo keeps moisture out. The silos each hold from 100 to 500 tons—depending upon diameter selected—12 to 24 feet.



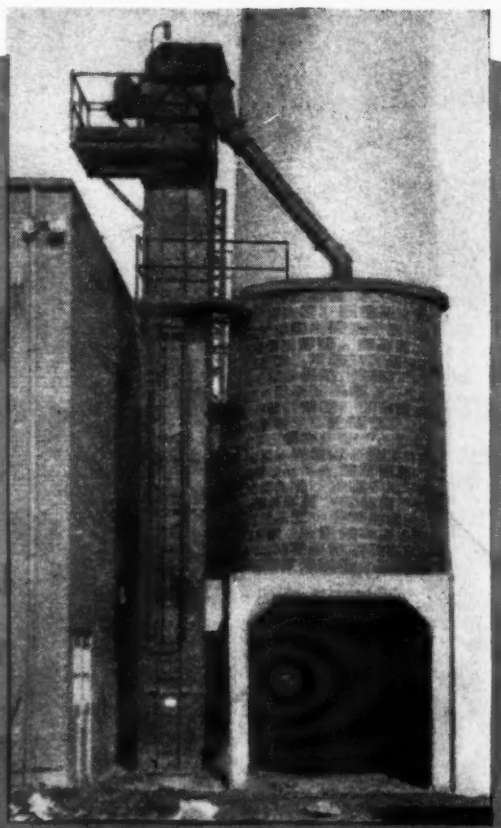
The Skip Hoist below is handling 50 tons of coal an hour. The Bucket has a 60 cu. ft. capacity and a lift of 102 feet.



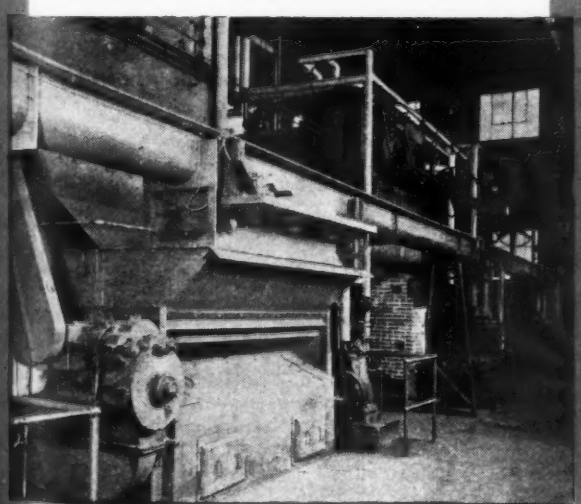
SYSTEM *to fit your specific need...*

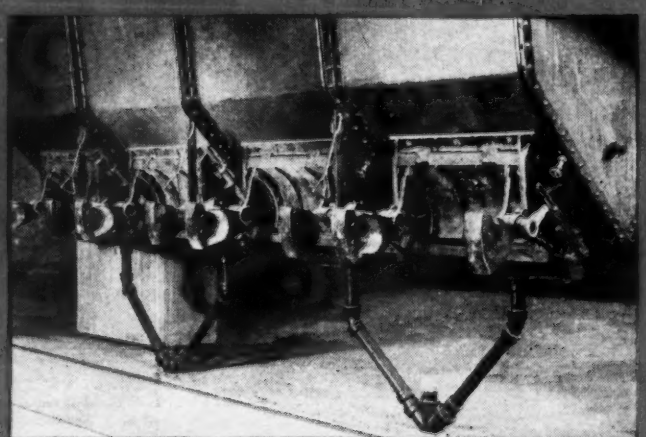
COAL AND ASH HANDLING EQUIPMENT

The Fairfield system may also include the clean, efficient disposal of ashes. At the right is shown an outside tile bunker into which the ashes are delivered by means of a covered conveyor and bucket elevator. A discharge gate in the bottom of the bunker permits trucks to back under bunker for loading by gravity. The illustration directly below shows ash hoppers with gates under 1500 H.P. Chain Grate Stoker which are installed directly below the boiler room floor—capacity each hopper 530 cu. ft. Cars are used to pick up ashes, siftings and soot as they are discharged. The cars usually dump into a skip hoist which delivers them to an outside ash bunker.



Directly below is illustrated a screw conveyor delivering coal from 320-ton outside silo to four stokers—coal is weighed by an automatic scale.

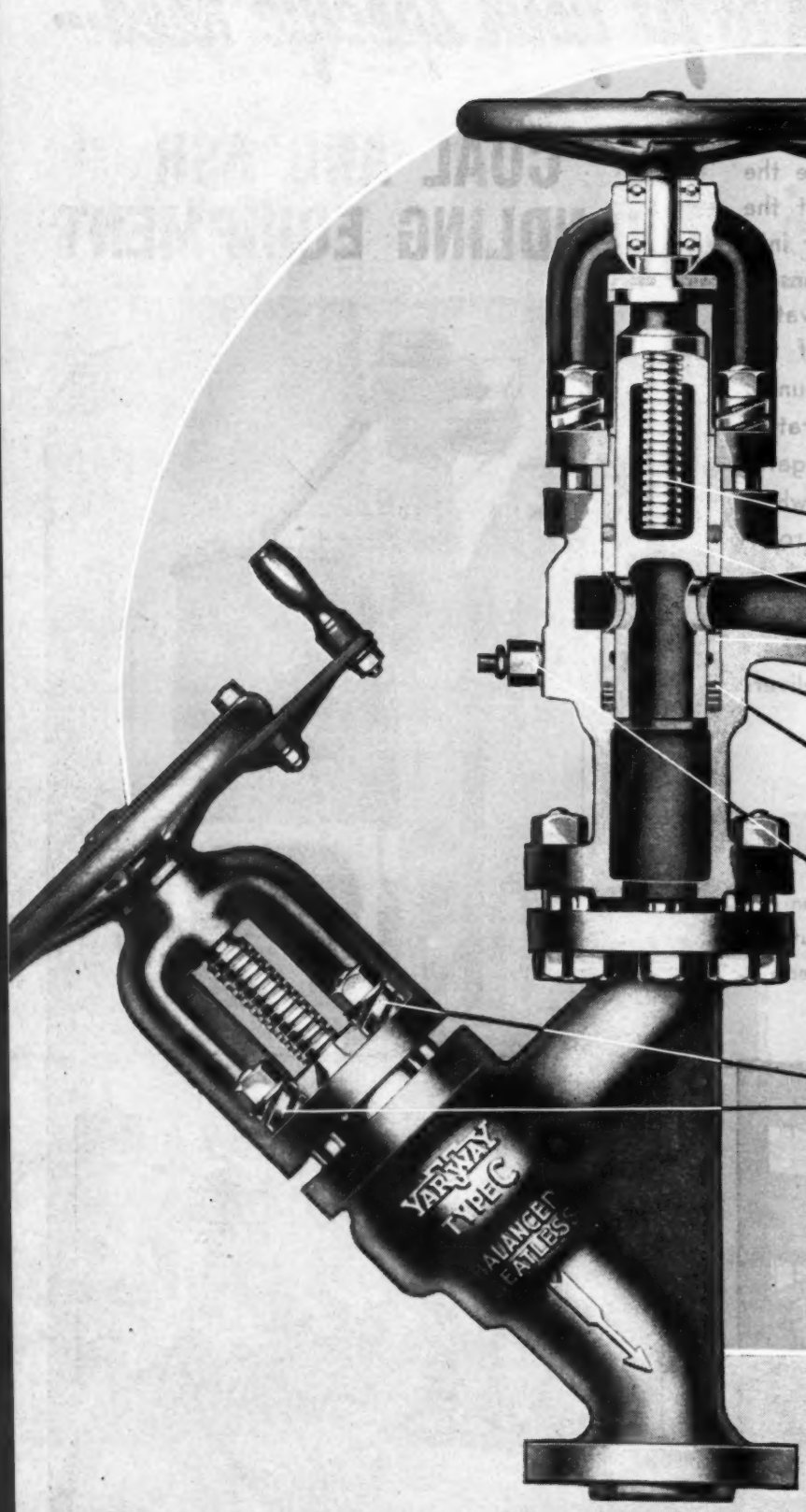




THE FAIRFIELD ENGINEERING CO.- MARION, OHIO

BUILDERS OF COAL AND ASH HANDLING EQUIPMENT

The Seatless Blow-Off Valve . . .



BECAUSE ★ ★ ★

"No Seat to Score,

Heat-treated steel stem.

Nitralloy Plunger and lower Follower Gland. Brinell hardness 1100 (upper Follower Gland, chromium plated steel).

Cast Steel Body and Yoke.

Laminated packing ring with stainless steel reinforcing inserts.

Alemite lubrication of Plunger (also for ball thrust bearings in yoke).

Yoke Springs maintain required pressure on packing at all times.

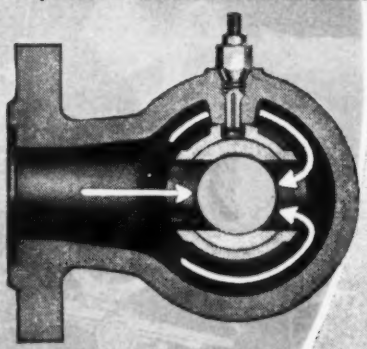
Yarway Type C Seatless Tandem Blow-Off Valve (angle valve Fig. 3910, straightway valve Fig. 3912) for pressures up to 600 lbs.

YARWAY

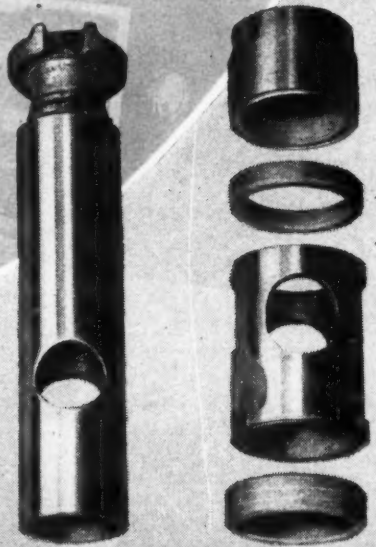
"Standard" in Over 12,000 Plants

Wear and Clog with Mud, Scale and Dirt"

Note ample space for free flow with no projections or pockets to accumulate scale or sediment.



Pressure surrounds Plunger making a fully balanced valve, easy to operate regardless of pressure.



Nitralloy Plunger and lower Follower Gland, and laminated packing with stainless steel inserts, add years to valve life.

More than a quarter century ago, Yarway introduced their Seatless Blow-Off Valve and said—"No seat to score, wear and clog with mud, scale and dirt." Power plant operators, harassed by continuous trouble and expense with conventional valves—welcomed the Yarway as the answer to their troubles . . . purchased them, watched them, standardized upon them. And the Yarway Seatless design, in a relatively short time, became the most widely preferred blow-off valve.

Today, after a quarter century of service, it still holds that distinction. Sound fundamental design...coupled with continuous mechanical and metallurgical research anticipating ever-new service requirements . . . makes the highly improved Yarway Seatless Valve of today just as good insurance against blow-down trouble and expense in today's plants as it was in the plants of twenty-five years ago.

There is a Yarway Valve for every pressure and purpose. Write for Catalog B-424 for pressures up to 400 lbs. Catalog B-431 for higher pressures.

YARNALL-WARING COMPANY
100 Mermaid Ave., Philadelphia 18, Pa.

BLOW-OFF VALVES

Why Hall System is as

distinctive as finger prints

We have made no mystery of Hall service. The developments of our research have always been published. Much of what we have learned is now common knowledge. Why, then, do we say that the Hall System is as distinctive as one's finger prints? It is really quite simple. Hall System of Boiler Water Conditioning stands on 3 legs like a tripod. Each leg is of equal importance. Each is a peculiarly Hall creation.

1. Preventive Care. This is based on the sound theory that if you know how to read the signs right, if you do the right things at the right time, you will seldom experience an unscheduled boiler outage. This is a strictly cooperative program. You and a Hall expert work together.

2. Laboratory Research. Heart and base of Hall theory is the conviction that scientific diagnosis is the one safe approach to a cure for boiler water evils. We have no faith in cure-alls or packaged remedies. That is why Hall field men are trained specialists not salesmen.

3. Continuity. One cannot keep a boiler operating at top efficiency by hit or miss observation. That is why we start a case history on each plant serviced. Constant, intelligent supervision is the only real protection.

But the real way to appreciate the distinction between Hall service and any other is to watch it at work—*in your own plant*. To help you make that important decision let us look your situation over and tell you how we could do for you what we are doing for so many others.

HALL LABORATORIES · HAGAN BUILDING · PITTSBURGH 30, PA.

HAGAN
HALL
BUROMIN
CALGON

HALL SYSTEM
of Boiler Water Conditioning

Hall Service in a Nutshell

At your immediate disposal are placed the technical knowledge and facilities of the pioneering leaders in scientific boiler water conditioning. In addition, with your full cooperation, Hall Service:

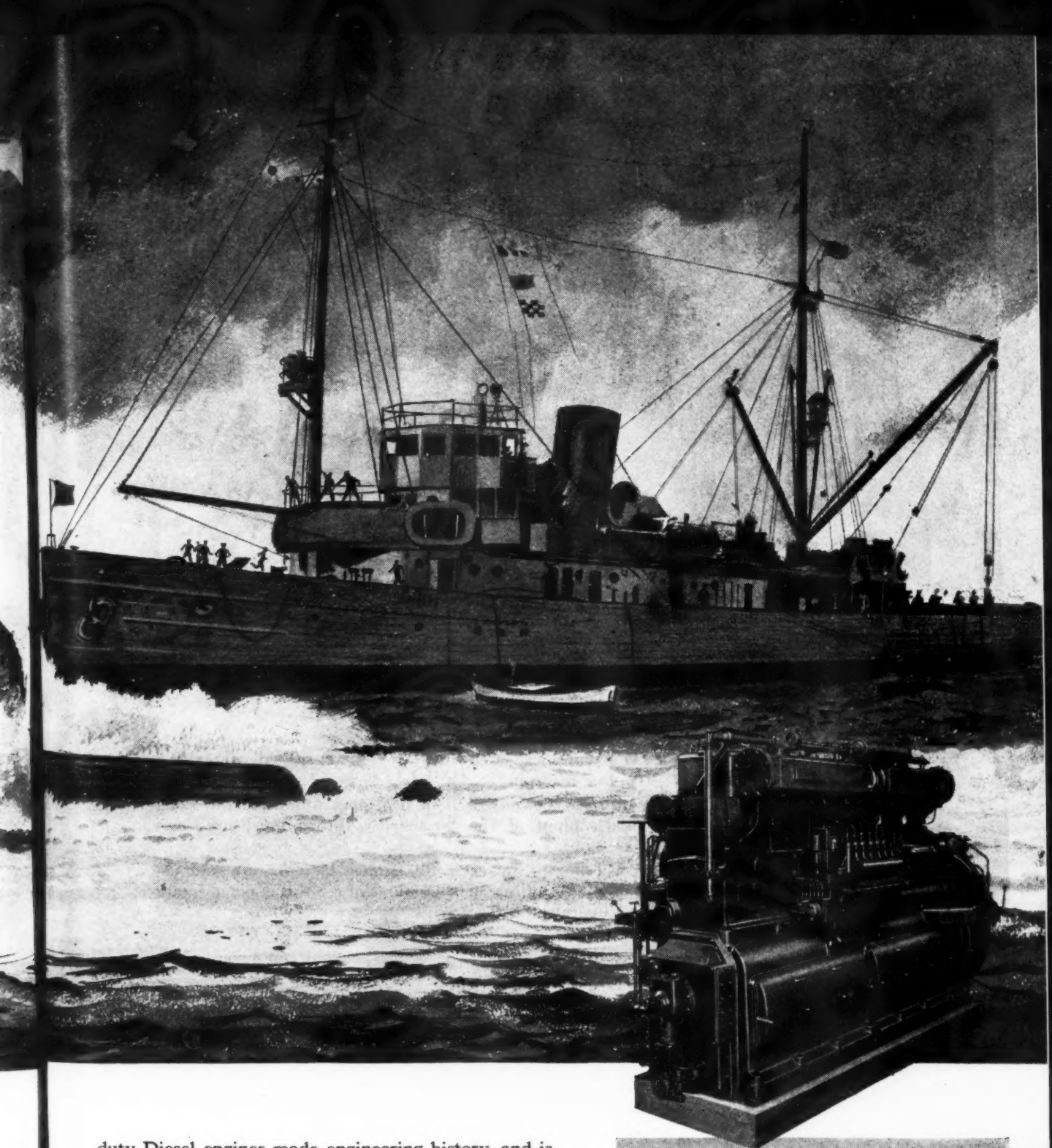
1. Minimizes boiler outages caused by water.
2. Helps maintain highest efficiency.
3. Establishes non-embrittling water.
4. Minimizes carryover.
5. Prevents corrosion in boilers and associated equipment.
6. Prevents deposition in water lines and cooling systems.

SUBMARINE RESCUE SHIP!

ALCO Diesel Engines in dramatic application where concentrated power is vital

This is a rescue ship—designed to aid crippled submarines. Here it is, actually raising a sunken "sub." Crowded with machinery and gear, these ships have no space to spare. Concentrated power is needed, and ALCO Diesel Engines furnish the type of space-saving, weight-saving power plant that "fills the bill."

Afloat or ashore, these great ALCO heavy-duty engines meet every power need for any service where maximum power-per-pound in minimum space is required —plus truly remarkable endurance. ALCO leadership in the development of lighter-weight, higher-speed, heavy-



duty Diesel engines made engineering history, and is recorded today in the performance of more than a million and a half horsepower of ALCO Diesel Engines now installed

War demands still require every Diesel engine ALCO shops can build. Important lessons are being learned from the enormous severity of this war service. Because of these lessons, plus continuous ALCO research, better and better ALCO engines are today being planned and built on ALCO drafting boards, in ALCO laboratories and in ALCO shops, for your postwar benefit.

American Locomotive

ALCO DIESEL ENGINES

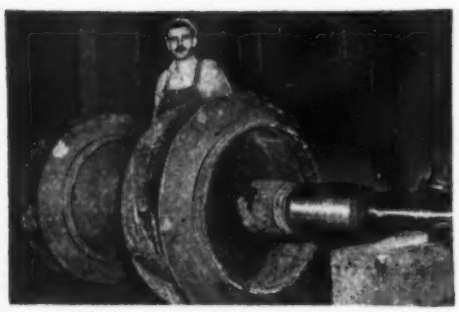
For Universal Application

30 Church Street, New York 8, N. Y.

SAVED

giant impellers put back to work by welding on cast Monel patches

CLOSE-UP OF WELDED MONEL "SHOES" on impeller vanes of large salt water pump in the Long Beach plant of Southern California Edison Co., Ltd. While some welds show cavitation after two years' exposure to swiftly moving sea water, the Monel patches remain relatively smooth and fit for long additional service.



TWO 48-INCH IMPELLERS, of manganese bronze, handle 50,000 gallons of sea water per minute in each pump. Welded Monel shoes proved so successful in one pump that similar patches were recently applied to the impeller vanes of a second large pump.

The pump impeller illustrated circulates salt water as a cooling medium.

It's one of four used in two giant pumps in the Long Beach plant of the Southern California Edison Company, Ltd.

The pumps, in service for almost 17 years, are each capable of handling 50,000 gallons of sea water per minute, and operate at 296 r.p.m.

As the 48-inch manganese bronze impellers are exposed to salt water at high speed, the original vanes were damaged long ago by corrosion and cavitation.

At first, repairs were made with bronze patches. These failed in a short time.

Then, over two years ago, new patches of cast Monel were welded in as replacements on one pump's impellers. Less than 100 lbs. of Monel was necessary to repair each 2000 lb. impeller. Since then, the impellers have given no trouble. Although some welds showed the effects of cavitation when examined a few months ago, the patches are relatively smooth and appear ready for many years more service.

Recently, the second pump's impellers were also fitted with welded Monel patches.

Monel not only welds readily,* but both the weld and the repair part *last*. Combining strength, toughness and high corrosion resistance, Monel is uniquely fitted for power applications where *all* of these properties are essential.

**Detailed welding instructions are given in our Technical Bulletin T-2—yours for the asking.*

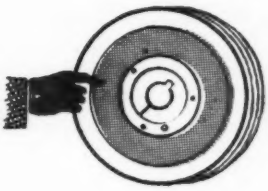
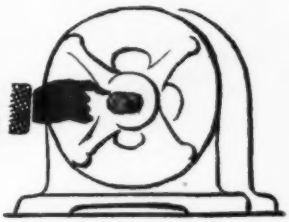
NICKEL (INCO) ALLOYS

THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL ST., NEW YORK 5, N.Y.

MONEL • "K" MONEL • "S" MONEL • "R" MONEL • "KR" MONEL • INCONEL • "Z" NICKEL • NICKEL • *Sheet... Strip... Rod... Tubing... Wire... Castings... Welding Rods*

It doesn't take this

to get

this  off this 

Allis-Chalmers' new "Magic-Grip" — *fastest mounting and demounting sheave on the market* — is removed from shaft in just 3 easy steps . . . saving you time, trouble, money.

1 **Remove three capscrews** from bushing collar. A handy wrench — supplied with each sheave — is the only tool needed to remove Allis-Chalmers' new "Magic-Grip" from motor or machine shaft quickly and easily.

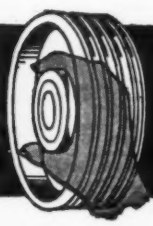
2 **Insert two capscrews** in tapped holes. As screws are turned, they become levers . . . automatically breaking tight grip of tapered split bushing on sheave and shaft. Entire unit is then ready for removal.

3 **Remove sheave from shaft.** Requires no mallet, no prying, no bulging muscles. You just slide the sheave off . . . smoothly, quickly. *It costs nothing extra!* Send for B6310. Allis-Chalmers, Milwaukee 1, Wis.

A 1758

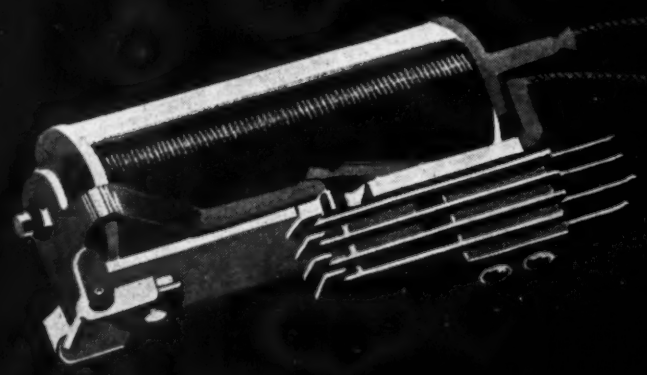
Allis-Chalmers Texrope

"MAGIC-GRIP"



SHEAVES

PROBLEM: To reduce atmospheric impairment of switchboards and circuits



SOLUTION: Control of humidity and air cleaning through air conditioning

MOISTURE on electric parts causes power leakage, deterioration of equipment, and faulty operation. When wiring insulation becomes damp, its dielectric value is lower. Faces of relay and other magnetic switches develop galvanic interference when moisture deposits are present. Such damage-threatening deposits of moisture occur when humid weather is followed by a rapid drop in temperature.

Dry weather is a threat to delicate mechanisms, too, for then dust is usually present in the air. Deposited on contact surfaces, in bearings, on precision parts, dust becomes a troublemaker.

The hazards of both moisture and dust were eliminated in 1937 by the Rochester Telephone Co., Rochester, N. Y., through Carrier Air Conditioning. The Carrier system controls humidity and temperature in the terminal room, the main operating room, and the long-distance operating room of the main exchange. By filtering the air, the equipment also removes the dust hazard and promotes cleanliness.

The benefits of more comfortable temperature levels, and of greater quiet obtained from keeping windows closed, are reflected in greater efficiency and better morale of personnel.

As to the effectiveness of air conditioning in telephone exchange operations—"Difficulties just don't show up," says the maintenance department of the Rochester Telephone Co.

If weather variations—temperature, moisture, or dust—are a problem in your operations or installations, you may find Carrier Air Conditioning a sure cure. Let Carrier discuss applications with you.

CARRIER CORPORATION, Syracuse 1, N. Y.

Carrier

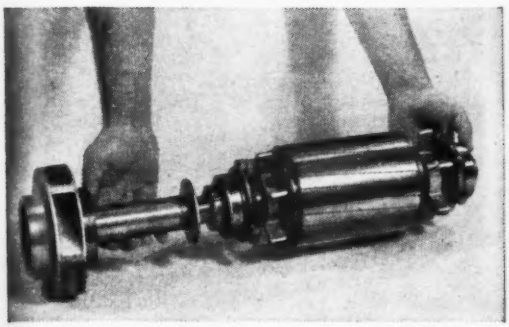
ARMY E NAVY

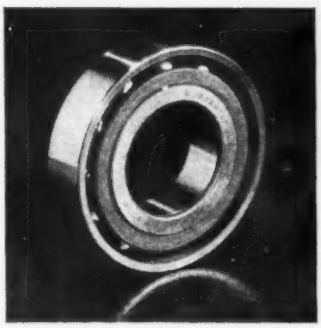
AIR CONDITIONING • REFRIGERATION

FORTY-TWO YEARS EXPERIENCE IN INDUSTRIAL INSTALLATIONS

[PUMP TIPS FROM ALLIS-CHALMERS—ONE IN A SERIES]

How to make CENTRIFUGAL PUMPS *Last Longer...*

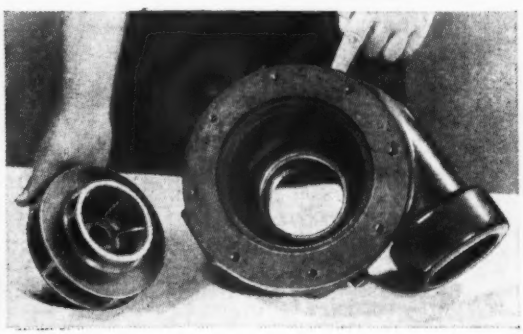




1 WHEN YOU HAVE an A-C "Electrifugal" pump you don't have alignment problems, for *both* impeller and rotor are mounted on *one* shaft. However, most pumps are coupled to separate motors... and how well the two are kept in alignment has a lot to do with how long they last. For timely help, get your *free* copy of Allis-Chalmers' "Handbook for Wartime Care of Centrifugal Pumps".

2 ALL BEARINGS AREN'T ALIKE. For example, while too much lubricant won't harm sleeve bearings, in anti-friction bearings it *promotes* friction. So play safe ... use only the *right* amount of the *right* lubricant — as recommended by your manufacturer.

3 SLEEVES WEAR UNDULY when water seal piping is plugged, lantern ring displaced, water is dirty or stuffing box gland is drawn too tightly. By keeping a constant check on such sources of wear, sleeve life can be materially lengthened. For valuable tips on how to locate, how to remedy these and other pump troubles, consult the "Handbook".



4 THE KIND OF PACKING, and *how* you use it have a lot to do with how long your pumps last. Commonest cause of trouble traces back to lack of "know-how" in caring for stuffing boxes. A quick picture of the *how* and *why* of efficient packing can be found in the "Handbook".

5 AN OFTEN OVERLOOKED CAUSE of impeller and casing wear is cavitation. For if a pump's capacity, head and particularly, suction lift aren't figured properly, this enemy can eat vital parts away fast. Allis-Chalmers' "Handbook for Wartime Care of Centrifugal Pumps" contains a step-by-step method for figuring head, plus tables of losses to help you apply your pumps correctly.

TODAY, with pumps working harder than ever and replacements difficult to obtain, you can't afford to take chances on maintenance. That's why Allis-Chalmers has published its "Handbook for Wartime Care of Centrifugal Pumps".

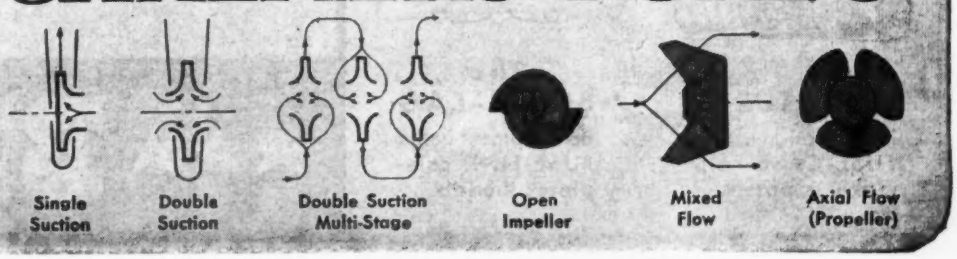
Write for your *free* copy of this valuable book today! It applies to *all* makes of pumps; contains *no* advertising.

And when you *do* need new pumps, look into the extra efficiency of A-C centrifugal pumps ... the "Electrifugal", and all types for every purpose. ALLIS-CHALMERS, MILWAUKEE.

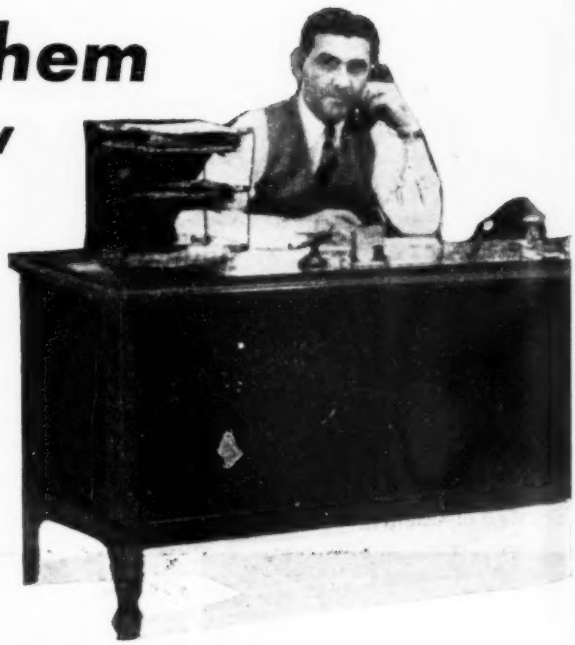
A 1776

ALLIS-CHALMERS PUMPS

Allis-Chalmers builds all types and variations of pumps shown at right. Capacities from 10 to 150,000 gpm—heads to 2500 lbs.



"We Reduced Production Delays By Installing BUSS Super-Lag FUSES. Now We Use Them Exclusively"



Reports **M. J. HYMEL,**
Purchasing Agent,
Service Foundry, Inc.,
New Orleans, La.

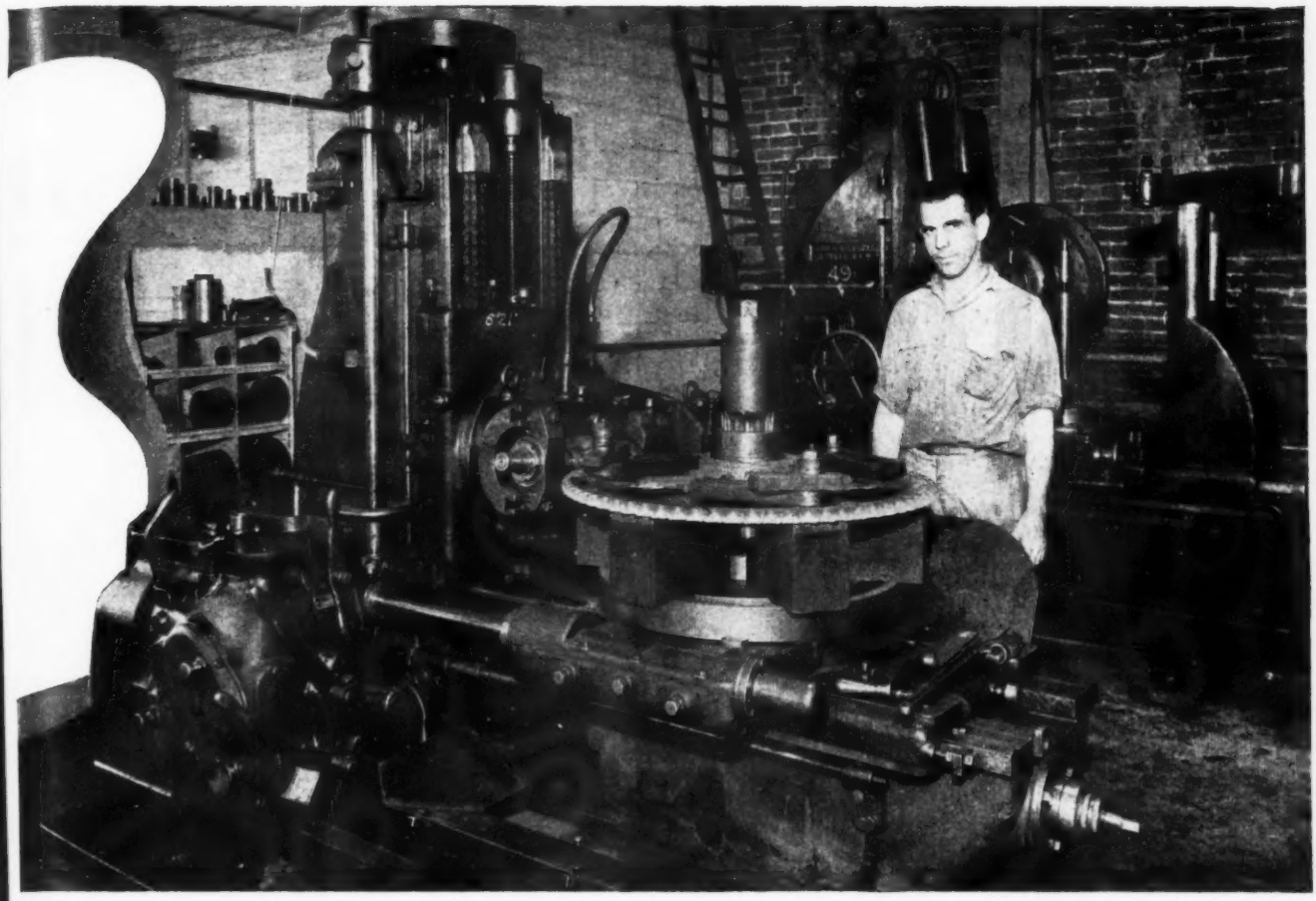
"About two years ago," says Mr. Hymel, "our electric motors were frequently shut down because fuses were blowing on motor starting loads. These shutdowns were costly—causing interruptions that cut production, disrupted scheduling, and made it difficult to meet delivery promises.

"A wholesaler's salesman had the right answer to our problem when he recommended that we discard our old fuses and use only Buss Super-Lag fuses. Since that time we have completely eliminated fuse blows due to motor starting loads. This convinced us. We have standardized on BUSS, because they have eliminated our troubles."

Why BUSS Fuses Don't Blow Needlessly

10 FEATURES in the design of the FUSE-CASE help make it possible. *and* ***The* SUPER-LAG** development in the FUSE-LINK completes the job.

★★★ **BUSS**



Gear Hobbing Machine in Service Foundry, Inc.

Here is another outstanding example that demonstrates how Buss Super-Lag fuses are helping to keep production running smoothly, how they reduce lost man-hours, and save trouble and grief for electricians and maintenance men.

If you have a problem similar to the one at Service Foundry, Inc., doesn't this example indicate how you can profit by the use of Buss Super-Lag fuses?

Buss fuses require no maintenance or periodic inspection. They don't open needlessly. If one opens, you can be sure some condition needs correction. When one opens, it requires less than 45 seconds to renew with an inexpensive link.

Why BUSS Fuses greatly reduce or entirely prevent needless blows

The fuse case is designed to insure good contact on the link, even when the fuse is renewed by an inexperienced person—and it is so designed that vibration or heavy overloads or the constant heating and cooling of the fuse will not permit poor contact to develop. Thus excessive heating, which causes fuses to blow needlessly, is prevented.

The fuse link used is the famous "BUSS Super-Lag." It has lag-plates attached to it. These give it a time-lag so long that it will reduce to an extent not possible with any other renewable fuse, the number of shutdowns caused by needless fuse blows.

Prevent future trouble in your plant—by doing this today

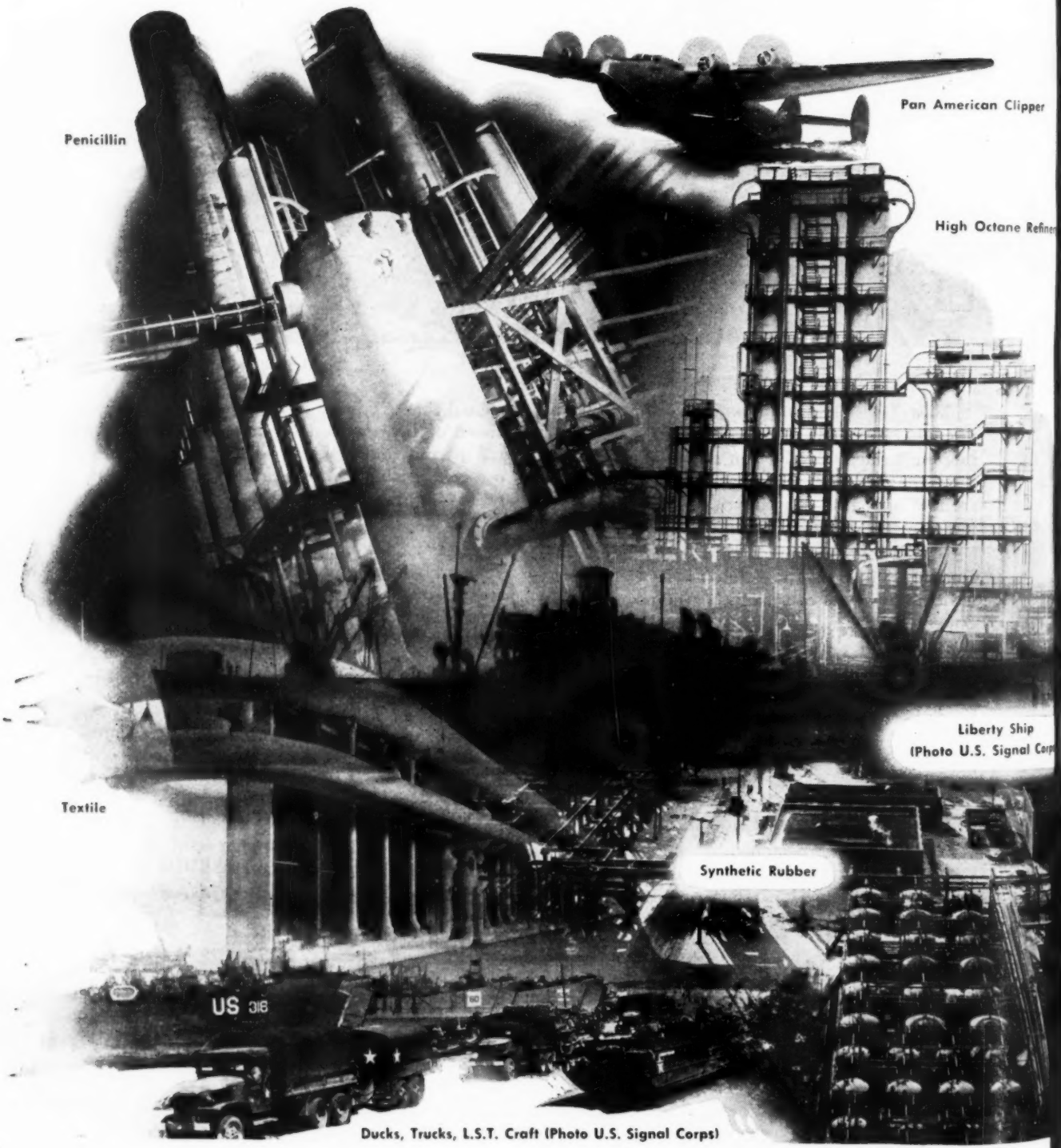
Pass the word along that all purchase records dealing with circuit protective devices should be immediately changed to call for BUSS Super-Lag Renewable fuses. Then, as fuses are replaced or new installations made, your plant will automatically get the benefit of the care-free, trouble-proof protection that BUSS Super-Lag fuses afford.

BUSSMANN MFG. CO. • ST. LOUIS 7, MO.

Division McGraw Electric Company

Super-Lag FUSES SOLD THROUGH WHOLESALERS

In the Nation's
In Its
LUNKENHEIMER



Ducks, Trucks, L.S.T. Craft (Photo U.S. Signal Corps)

ndustries . . .
mplements of War . . .
VALVES have established
a Notable Service Record

In tanks and jeeps, bombers and pursuit planes, "ducks" and landing craft, submarines and Liberty cargo ships—in the busy industries which turn out America's vast armaments—in giant refineries, synthetic rubber units, chemical and power plants—on every front LUNKENHEIMER VALVES are performing a *vital, indispensable* service.

Highest grade materials, simplicity of design, rugged durability, super-accurate machining of every part—these are qualities which have made LUNKENHEIMER VALVES a leading choice of American industry for over three quarters of a century.

In addition to superior workmanship which comes of long-accumulated experience, rigid tests at every step in the manufacturing process assure dependable performance and low-cost maintenance in these *Longer-Life* Valves.

Your LUNKENHEIMER Distributor is always ready to help you with problems of maintenance, repair, and operation. His facilities are at your service.

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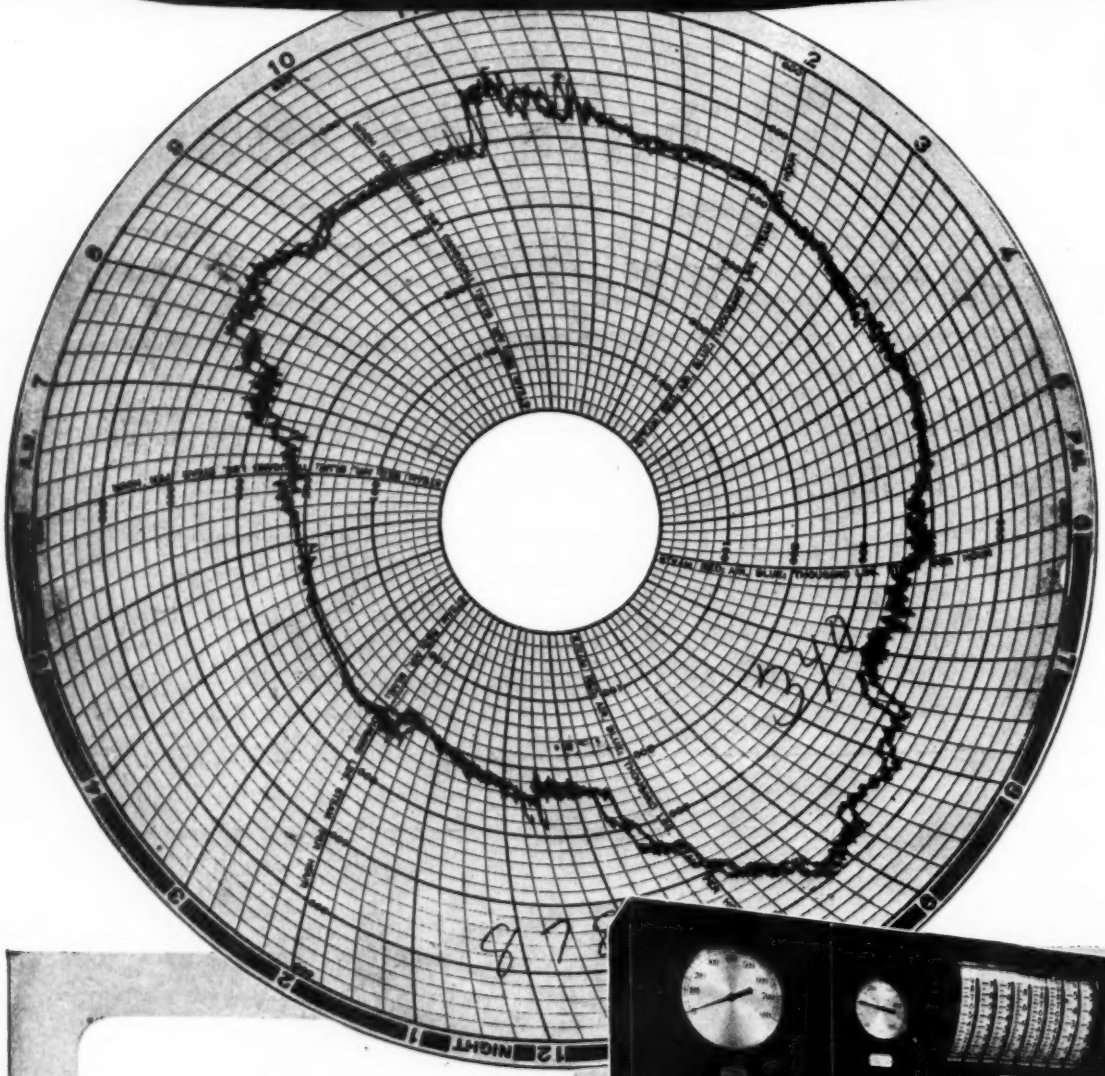
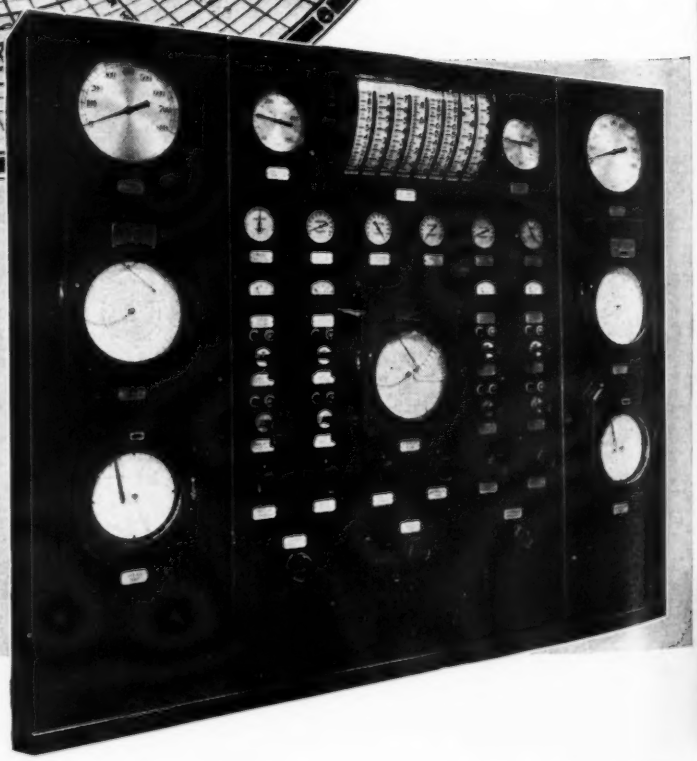
BRONZE, IRON, STEEL AND CORROSION RESISTANT ALLOY VALVES, 125 TO 2500 LB. S.P., BOILER MOUNTINGS, LUBRICATING DEVICES, AIRCRAFT FITTINGS

FOR THE UTMOST IN C





Steam and air flow chart taken from a Hagan controlled boiler. Note the close control of air in relation to steam flow.

A mechanical brain that thinks for your operating staff and makes all changes quickly and automatically. Hagan Control responds to the slightest fluctuation of steam, gets maximum efficiency from your boilers.

COMBUSTION CONTROL

. . . Look to Hagan!

HAVE you ever wished for combustion control so finely engineered and so dependable that it would operate at maximum efficiency with little or no attention?

Have you ever wanted a system so simple, sturdy and fool-proof that it gives you accurate, dependable performance, year in and year out, with a minimum of maintenance?

Would you like the assurance that you would be getting the utmost benefit from every pound of fuel?

Then you can safely look to Hagan. For that is the kind of control service it is giving to its thousands of users. You can read the story on their control charts.

Hagan Automatic Combustion Control was the first efficient system for its purpose ever built. The Hagan record has been one of continuous pioneering of major improvements ever since. This unbroken leadership has but one explanation: the employment of the right control principles by engineers with the greatest wealth of combustion experience.

For complete facts in support of these statements just write or call us.

HAGAN CONTROL ASSURES:

MAXIMUM QUANTITY of steam from any given plant, by introducing fuel and air in correct proportion.

MAXIMUM UTILIZATION value and uniform steam pressure.

MAXIMUM OUTPUT from boilers of different capacities.

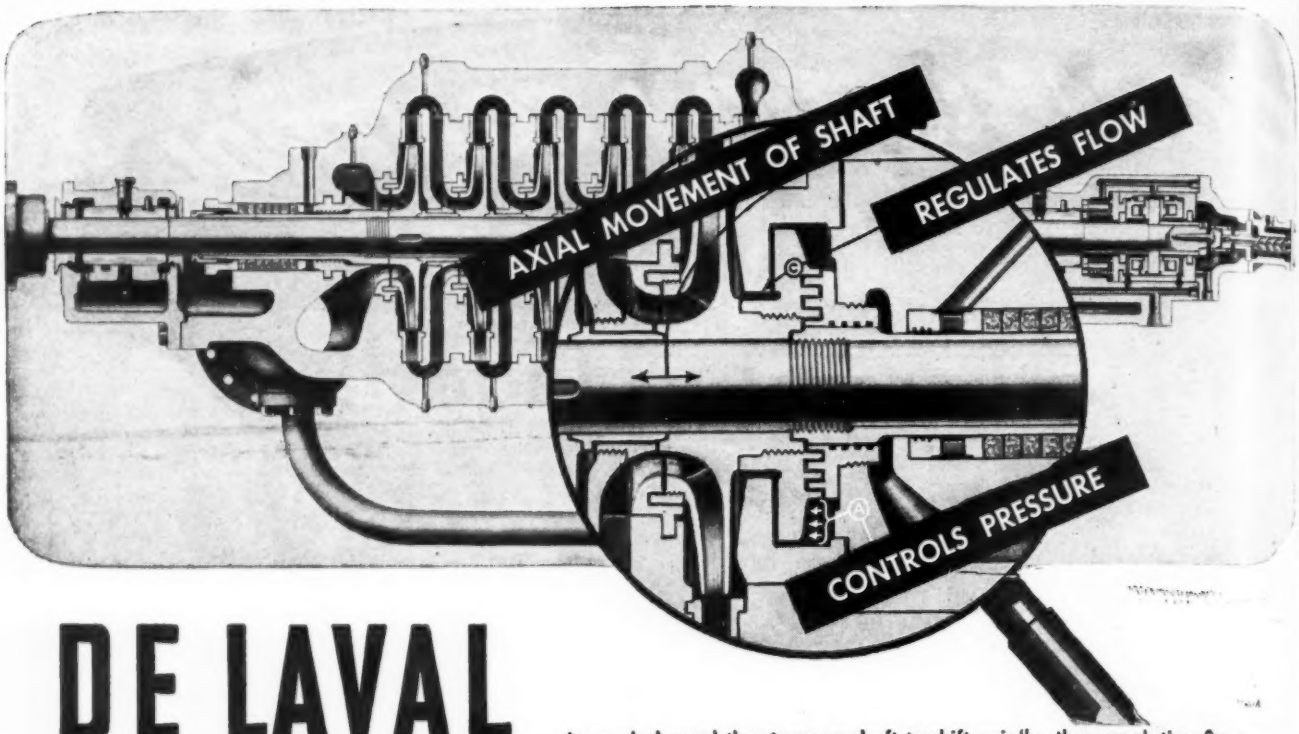
MAXIMUM PROTECTION of auxiliary equipment, fans, stokers, etc., by maintenance of uniform operating conditions.

HAGAN HALL BUROMIN CALGON

HAGAN CORPORATION · HAGAN BUILDING · PITTSBURGH 30, PA.

HAGAN *Automatic* COMBUSTION CONTROL

The pioneer . . . and still the leader



DE LAVAL

BALANCING ARRANGEMENT *Automatically* BALANCES ALL THRUST

Any unbalanced thrust causes shaft to shift axially, thus regulating flow through clearance C, thereby controlling pressure against balancing disc A and thus automatically returning the pump to a state of perfect balance. Note that this hydraulic device leaves no unbalanced thrust to be taken up by bearings or other metallic contacts subject to wear.

ELIMINATES SOURCE OF TROUBLE IN HIGH-PRESSURE BOILER FEED PUMPS

The erosive action of high-temperature feed water in a high-pressure boiler-feed pump does not interfere with the operation of the De Laval automatic hydraulic balancing arrangement, since the automatic action of this device is in no way affected by normal wear, as can be seen from the illustration. Its universally trouble-free performance has been demonstrated over a period of 30 years in hundreds of installations, handling feed water up to 350° F. and discharging against pressures up to 1600 psi.

3630

TURBINES • HELICAL GEARS • WORM GEAR SPEED REDUCERS CENTRIFUGAL PUMPS • CENTRIFUGAL BLOWERS and COMPRESSORS • IMO OIL PUMPS

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POWER

NOVEMBER, 1944 VOLUME 88, NUMBER 11

A CROSS-INDEX OF SUBJECTS FOR THE MONTH

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TURBINES, ENGINES, AUXILIARIES; HYDRO POWER
DIESELS, GAS ENGINES AND ACCESSORIES
AIR CONDITIONING AND REFRIGERATION
ELECTRICAL EQUIPMENT, ELEVATORS
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INSTRUMENTS, CONTROLS
PUMPS, COMPRESSORS

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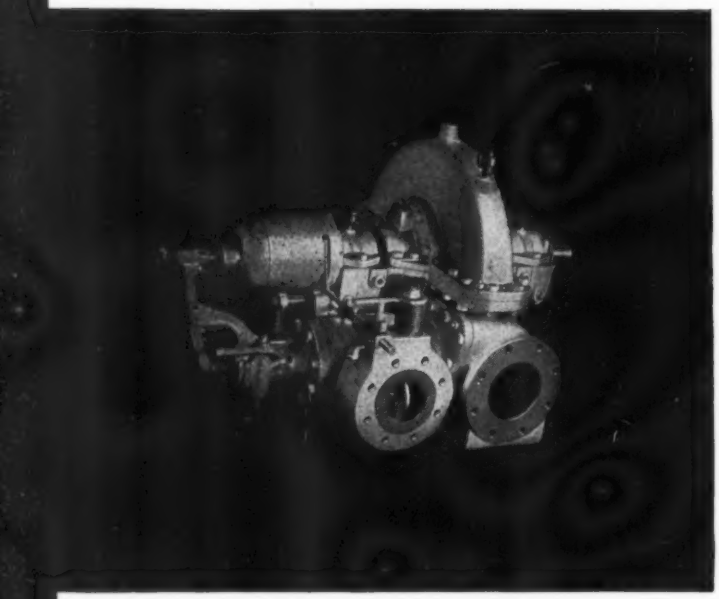
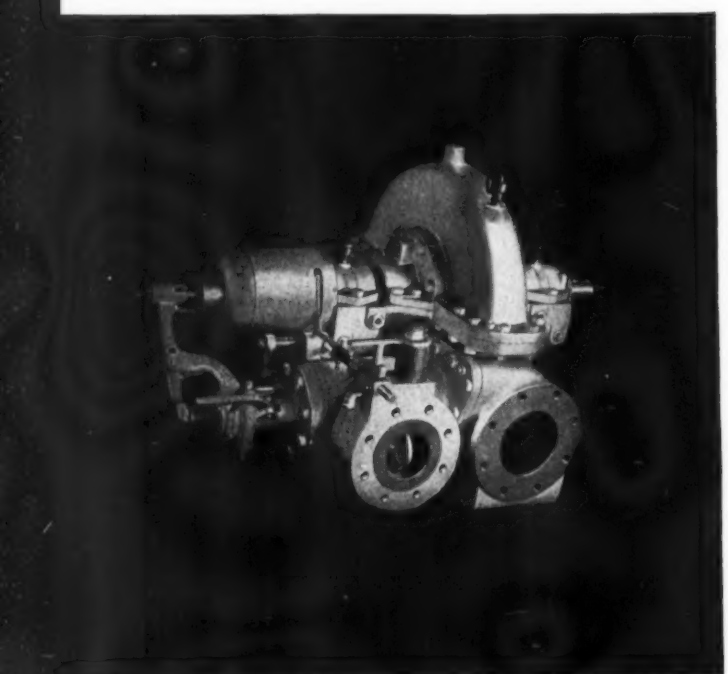
TO SOLVE YOUR MECHANICAL DRIVE PROBLEMS



Type C-14 Single-stage General-purpose Turbine. Built for service at 5 to approximately 200 hp; speed range 1000-5000 rpm. Suitable for use with steam pressures through 600 lbs. gauge, and for total temperatures through 750° F.

TURBINE HELP QUICK. When you need steam for mechanical drives, phone Westinghouse Steam Headquarters. Because Westinghouse maintains offices in every major city, a trained industrial engineer can be in your plant quick—ready to discuss your steam problems and recommend the turbine your job requires. You'll find a "Westinghouse office near you" handy—especially on rush war jobs.

COMPLETE LINE. A call to Steam Headquarters eliminates the bother of "shopping" for the size turbine your steam conditions require. Westinghouse builds a complete line of mechanical drive turbines—from 5 to 3000 hp—PLUS a complete line of auxiliary equipment. So with one purchase order, you centralize responsibility for design, manufacture, delivery and servicing of all your mechanical drive turbines and auxiliaries.



Type C-20 Single-stage General-purpose Turbine. Built for service up to approximately 600 hp; speed range 1000-5000 rpm. Suitable for use with steam pressures through 600 lbs. gauge, and for total temperatures through 750° F.

Westinghouse

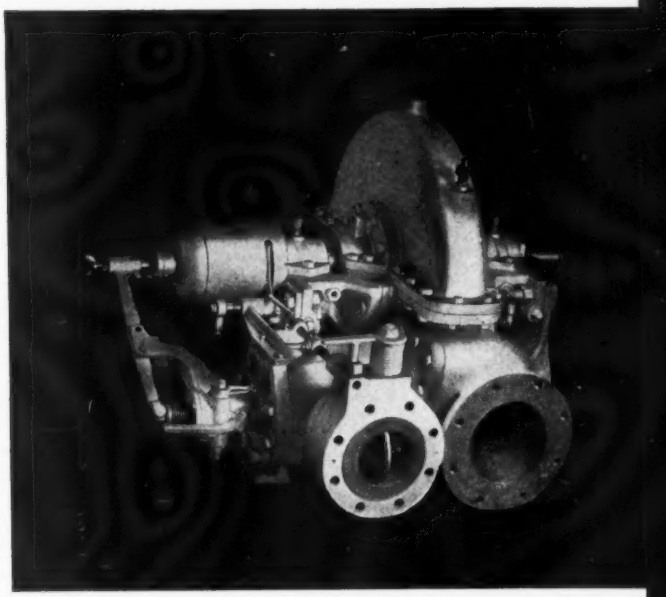
PLANTS IN 25 CITIES ... OFFICES EVERYWHERE

Steam Headquarters

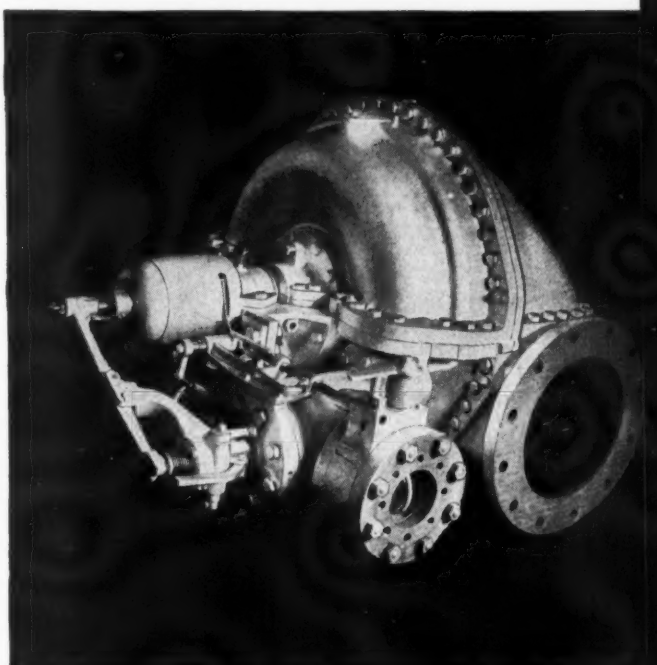
PHONE - - *Steam Headquarters*

EXPERT DESIGN. Most mechanical drive turbines require only a small amount of special steam designing. But when unusual steam conditions are encountered, expert design help is necessary. Steam Headquarters maintains a permanent staff of steam design experts who daily engineer turbines for all varieties of conditions. Each Westinghouse turbine you buy is matched to its job.

NATIONWIDE SERVICE. Installing your turbine—getting it running—and KEEPING it running is the responsibility of our nationwide Steam Service. Westinghouse turbines are built to keep service requirements at minimum. But in an emergency, your Westinghouse Steam Serviceman is as near as your telephone—ready to act as turbine trouble shooter . . . anywhere . . . any time of night or day. J-50446



Type C-25 Single-stage General-purpose Turbine. Built for service up to approximately 1200 hp; speed range 1000-5000 rpm. Suitable for use with steam pressures through 600 lbs. gauge, and for total temperatures through 750° F.



Type C-225 Two-stage General-purpose Turbine. Built for services through approximately 1500 hp; speed range 1000-5000 rpm. Suitable for use with steam pressures through 600 lbs. gauge, and for total temperatures through 750° F.

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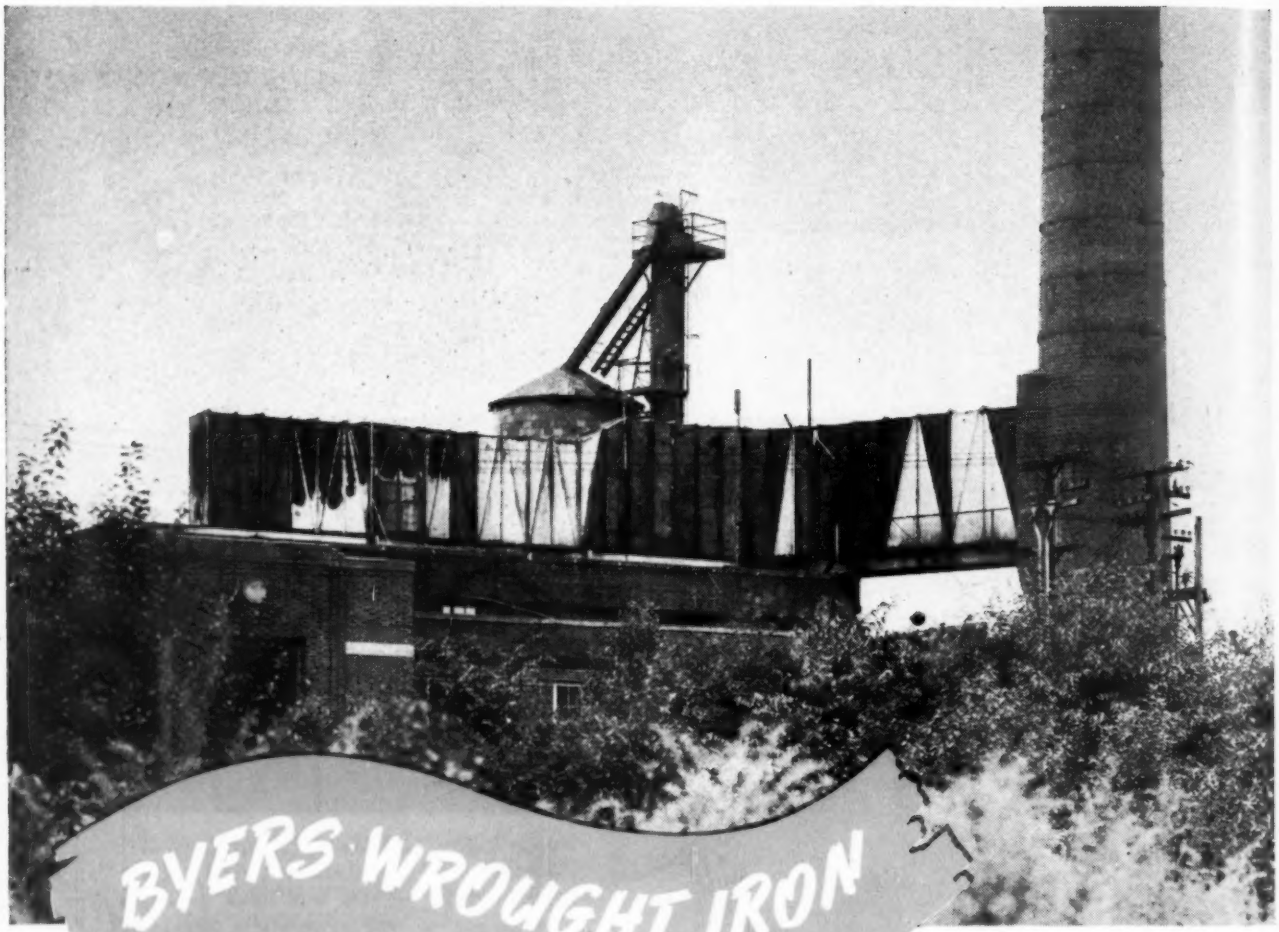
PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE



BYERS WROUGHT IRON gave this breeching a new lease on life

When the boiler breeching in the Orrville, Ohio, Municipal Power Station started to fail, the engineers launched a planned repair program just recently completed. The story may give you some valuable tips if you, too, must make repairs on the run . . . and still want a job that will *last*.

The original breeching was built in 1929 of low-first-cost materials, and an extension was added in 1936. In 1937 most of the original breeching was in such a shape that replacement was necessary. "Gussets" of wrought iron, cut to right triangles, were welded into place on the frame. Some time later, the balance of the original breeching was replaced with wrought iron, and this year the extension was similarly treated. Inspection of the wrought iron installation, which had already almost equaled the life-to-failure of the original material, showed it still in excellent condition.

Boiler breechings are an application where some corrosion must always be anticipated—and where things may change for the worse at any time. The carbon dioxide that is always produced when fuel is burned will—if absorbed by moisture—form an active acid. The same is true of any sulfur compounds that may be in the fuel. As the experience cited would suggest, wrought iron is unusually resistive to this attack. The reason lies in its unique structure.

Wrought iron consists of a high-purity iron base, through which multitudes of tiny silicate slag fibers are threaded. The fibers themselves are unaffected by acid. Because of their distribution, they act like a picket fence in spreading and diffusing the attack, and so prevent the pitting that generally causes failure in ordinary materials.

You will find a helpful discussion of the subject of smoke corrosion, and some interesting reports on the experience of users with wrought iron, in our technical bulletin, "Wrought Iron for Flue Gas Conductors and Coal Handling Equipment." We will be very glad to send you a complimentary copy.

A. M. Byers Company. Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

BYERS
GENUINE WROUGHT IRON
TUBULAR AND HOT ROLLED PRODUCTS
ELECTRIC FURNACE ALLOY STEELS · OPEN HEARTH ALLOY STEELS
CARBON STEEL TUBULAR PRODUCTS

POWER

PHILIP W SWAIN, EDITOR · NOVEMBER 1944 · ESTABLISHED IN 1882

What About Germany?

ENGINEERING ORGANIZATIONS have no proper place in politics, national or international, but they should give the nation the benefit of their technical knowledge when machines, materials and production are concerned. The recent public statement regarding Germany by the presidents of the five major engineering societies (ASME, ASCE, AIMME, AIEE, AIChE) is an outstanding example of such disinterested public service.

These five men, speaking as individuals but with the prestige of their offices, showed how Germany can be kept powerless for war without destroying her capacity to produce the industrial goods and services essential for the restoration of normal life in Europe.

As engineers they had no advice to offer on matters of international relations, politics or diplomacy, but they did put the finger on certain items of raw materials, plants and products essential to war, yet representing only two percent of Germany's normal peacetime employment. Controlling these, they said, will completely throttle Germany's war-making power without appreciably damaging her peacetime contribution to the general welfare.

Reduced to bare outline, here are the proposals:

1. Eliminate and prohibit all synthetic oil plants. Synthetic oil costs far more than the imported natural product. It is completely uneconomical for Germany *except for war*.

2. Destroy 75 percent of Germany's synthetic nitrogen plants. The remainder will produce enough for fertilizer, but not for explosives. Forbid the building of new nitrogen plants, also the importation of nitrogen compounds beyond a controlled minimum of dynamite for quarrying, etc.

3. Destroy half of Germany's steel-making capacity in those categories most necessary to war, notably high-alloy steels and heavy steel forgings. Limit imports of iron ore, fluxing material, alloying elements and steel products to normal requirements.

4. Prohibit all aluminum plants, all aircraft plants and equipment. Stop all imports of bauxite (aluminum ore). Restrict aluminum imports to peacetime needs.

These are matters within the engineer's field of practical knowledge. He knows that the enforcement of *any one* of these four industrial proposals would effectively prevent Germany's fighting another war. All four together would be fully adequate insurance, without any appreciable cramping of Europe's peacetime industrial economy.

Enforcing this or any other plan to keep Germany in line will take half a century of vigilance. This policing is a matter for citizens to demand and statesmen to execute. The engineers have merely stated what is reasonable and necessary in terms of the physical facilities they know and understand.

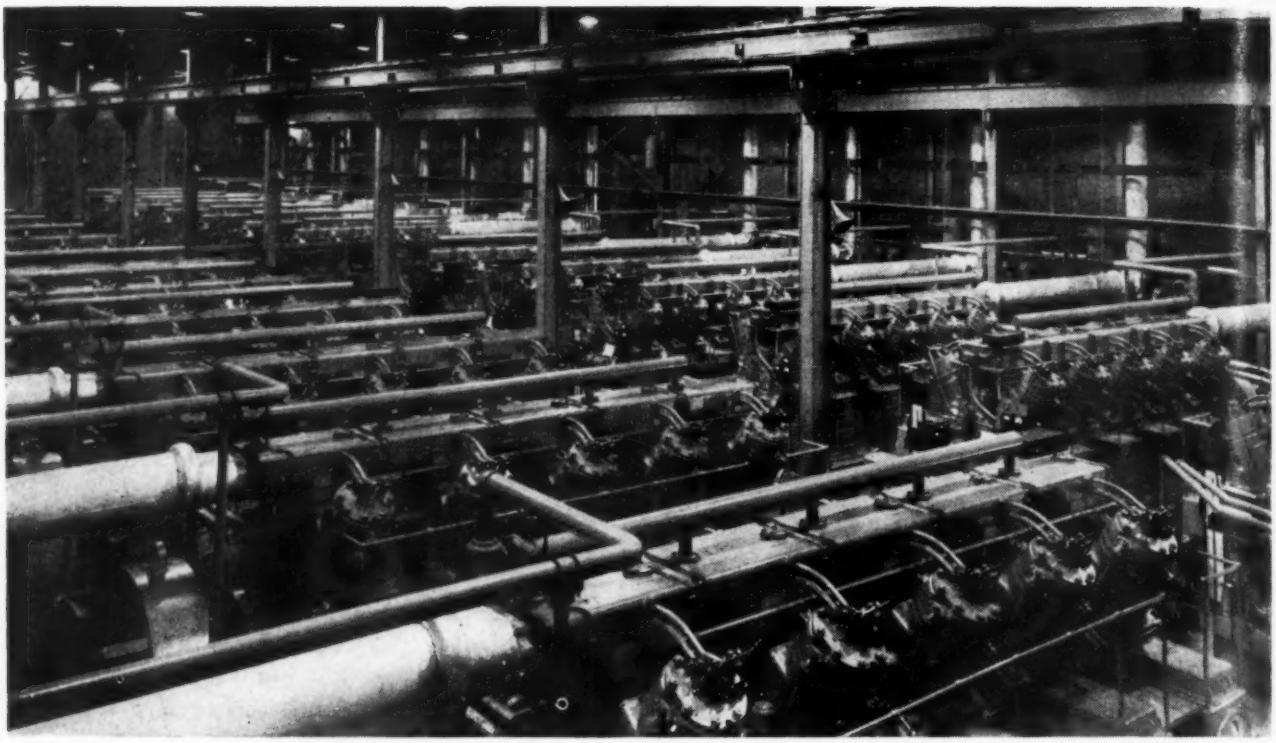


Fig. 1—General view of one of the four engine rooms; this one houses 25 gas engines, each driving a 750-kw dc generator

World's Largest Gas-Engine Plant, Rated At 78,000 Kw, Powers Aluminum Works

Efficient generation from cheap fuel meets need for low-cost dc energy at works near ore source. Sound design coordinates 68 prime movers and auxiliaries into an effective layout

▶ FROM THE TIME WHEN Charles Martin Hall first made aluminum a commercial reality, dc electrical energy has been a basic ingredient, virtually as important as the aluminum oxide from which the metal is made. Thus over-all energy cost and reliability of service loom as paramount engineering factors in every aluminum-plant design.

Heretofore, power demands have been met by high-voltage ac hydroelectric stations with mg sets or mercury-arc rectifiers for conversion to dc. However, when Aluminum Co of America started design of a Defense Plant Corp works at Jones Mills, Ark., near large ore sources at Bauxite, lack of available hydro power and war urgency turned attention to other sources, notably steam power, where advent of higher pressures and temperatures had raised efficiency to new levels. Out of preliminary studies grew plans for a modern plant with three 35,000-kw turbine-generators.

At this stage, difficulty in securing turbine allocations necessitated examining other possibilities for at least part of the load. Studies revealed that internal-combustion engines driving dc generators compared favorably on an economic basis with ac turbine-generators and conversion equipment, and that engines could be delivered promptly. First decision to install engine capacity roughly equivalent to one turbine-generator was followed shortly by another order doubling the engine capacity.

Meanwhile, formation of the Southwest Power Pool, including government projects, REA plants and utility systems, made transmission-line power available and it proved advisable to abandon the steam power project entirely, thus releasing turbine capacity for more urgent needs.

As completed, the Jones Mills Works consists of four pot lines, with a carbon-anode plant and the usual auxiliary facilities. Transmission-line power supplies two pot lines; engine-generators supply the other two. Engine-plant capacity totals 78,000 kw in 68 units; 18 Nordberg gas-diesels (40,500 kw) and 50 Cooper-Bessemer convertible gas engines (37,500 kw). Orders went out March 10, 1942; first units went into service Nov 23, 1942, and the remainder were installed as received. Final unit began operation June 2, 1943, total elapsed time being 15 months.

Sound engineering overcame the apparent difficulties of coordinating an unusual multiplicity of units and produced an effective layout. In determining number, size, type and arrangement of buildings to house this power plant, designers considered such factors as reducing voltage drop by minimum con-

ductor size, insuring adequate ventilation, simplifying piping and control systems and providing operating safety and accessibility. To best satisfy these requirements, four single-story windowless and basementless brick-and-steel structures were erected, each approximately 120 ft wide, 255 ft long and 33 ft from operating floor to roof truss. A rail siding serves each building and each is equipped with overhead cranes.

One pair of buildings houses the Cooper-Bessemer engines, 25 units in each, and the other pair houses the Nordbergs, nine in each. Arrangement of engines and auxiliary equipment in each plant differs in detail but follows a similar pattern. In each case, individual engine units are identical and completely equipped for fully independent operation.

The 25 Cooper-Bessemer engines in each building are arranged in two rows, with control ends facing a center aisle, Fig. 1. They are 1165-hp 10-cyl 14x14-in. 350-rpm 2-cycle units, modified from the GMV design. Basically an engine-driven compressor, the standard GMV unit is convertible from a natural-gas engine to a full diesel. Under normal conditions, vertical units designed for power generation would have been offered for this installation, but availability of manufacturing capacity at Cooper-Bessemer's Mt. Vernon, Ohio, plant made it possible to deliver much more quickly GMV units, modified for non-compressor use. With time of the essence, this proved satisfactory to Aluminum Co engineers and the resulting engines need no apology.

Fig. 2 shows a typical unit, as installed, and Fig. 3, a cross-section, includes changes from basic GMV design. Normally, compressor cylinder bolts beyond scavenging pump, compressor

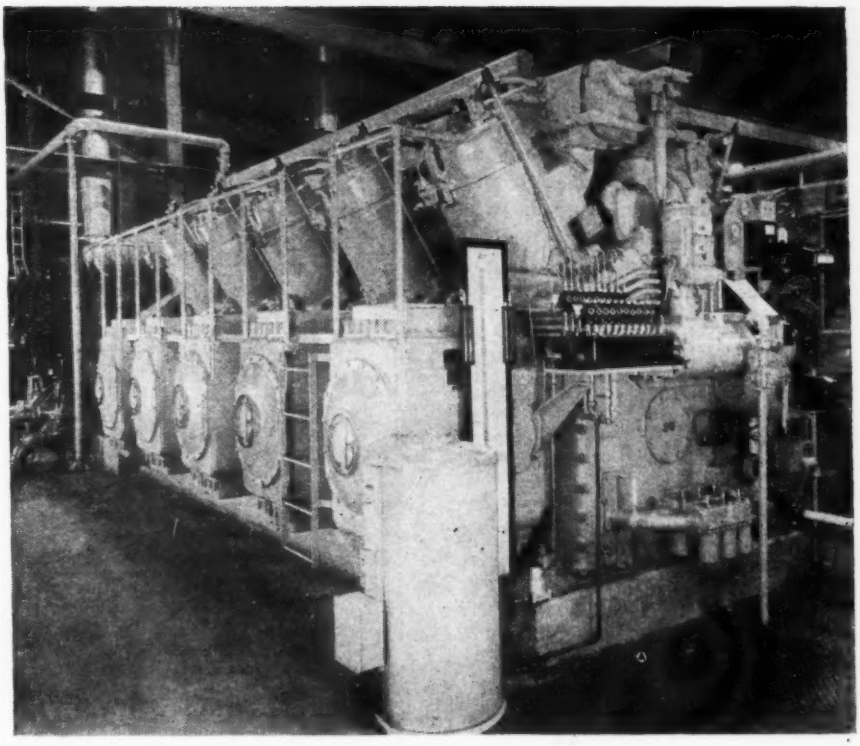


Fig. 2—Scavenging-cylinder side of 1165-hp 10-cyl 14x14-in. 350-rpm 2-cycle Cooper-Bessemer GMV convertible natural-gas engine, typical of the 50 units installed

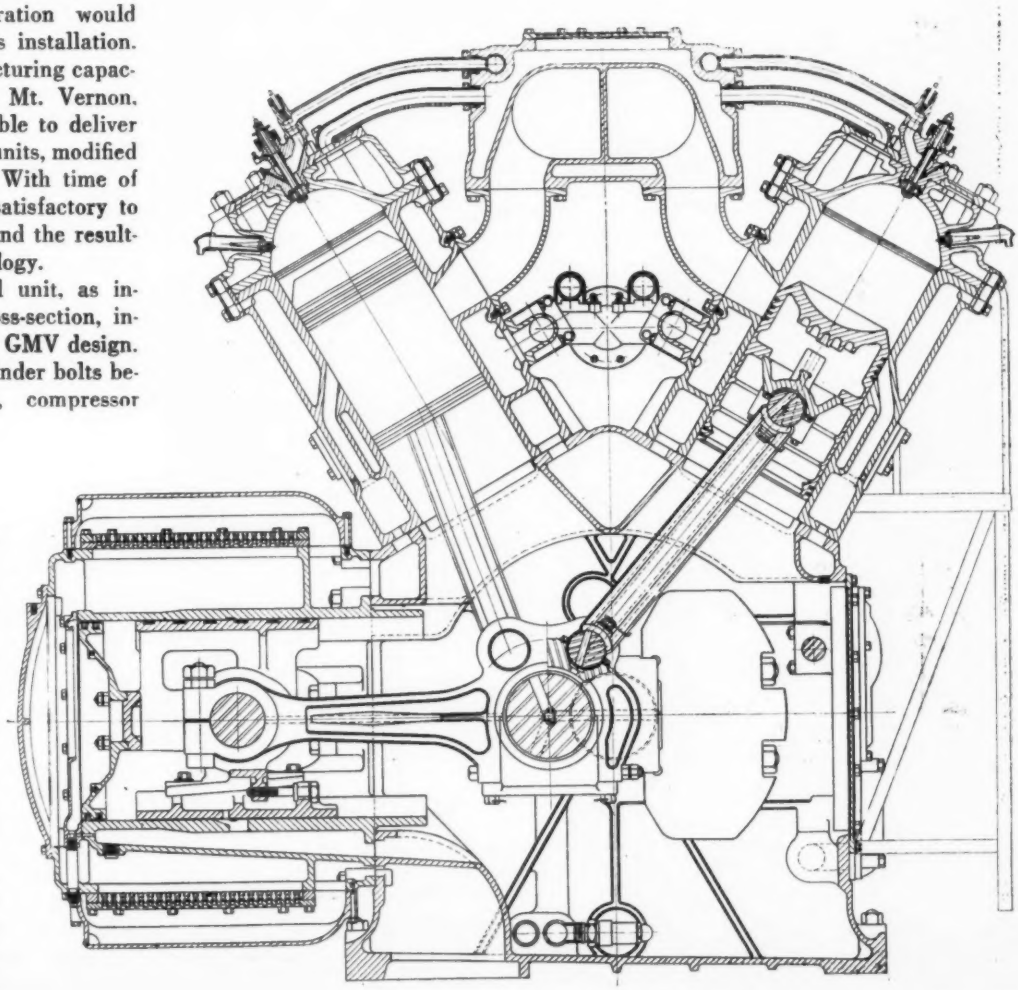


Fig. 3 — Cross-section shows how GMV engine, usually built for compressor drive, with compressor cylinder mounted beyond scavenging pump, was modified by redesigning compressor crosshead into a lightweight unit and shortening crosshead guide so that it would not project as far as when used for compressor drive. Connecting rod is articulated; master rod drives the compressor crosshead and power pistons are linked to the master. There is a scavenging piston on each crankthrow

crosshead carrying scavenging piston. To save materials, Cooper-Bessemer engineers redesigned crosshead for lighter weight and shortened crosshead guide.

In other respects, these engines follow the usual GMV practice. This accounts for the fact that even though the 60-deg-V power cylinder arrangement makes for space saving, these engines are somewhat longer than absolutely necessary for a power unit, as the standard GMV unit has long cylinder centers to permit use of large-diameter compressor cylinders. Connecting rod is articulated; master drives compressor crosshead and power piston rods link to master. There is a scavenging piston on each crankthrow, with suction valve at bottom and discharge at top. Location and shape of air ports produce uniform velocity and prevent mixing of air and exhaust gas. Scavenging air, directed by port shape and piston top, flows upward on cylinder's inlet side and downward on exhaust side. Symmetrical power pistons contain a space below crown that is partly filled with oil; reciprocating motion causes violent turbulence, greatly increased heat conductivity and effective piston cooling. Typical Cooper-Bessemer saddle-end wristpin design (See Fig. 3.) makes a crossbore through piston wall unnecessary.

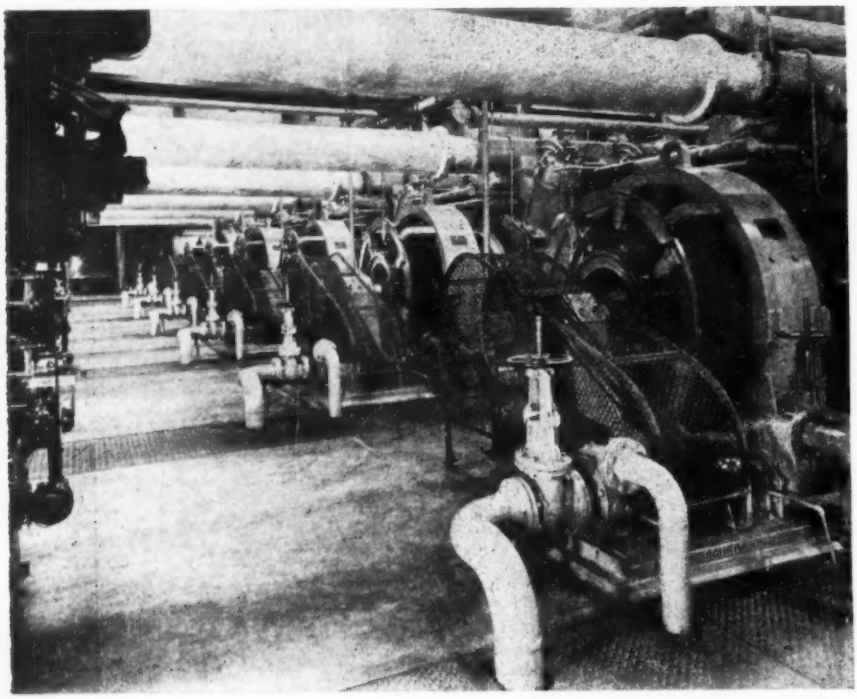


Fig. 4—Aisle at rear of Cooper-Bessemer engines, showing belted jacket-water and raw-water pumps. Photo below shows equipment at left side of aisle, along wall

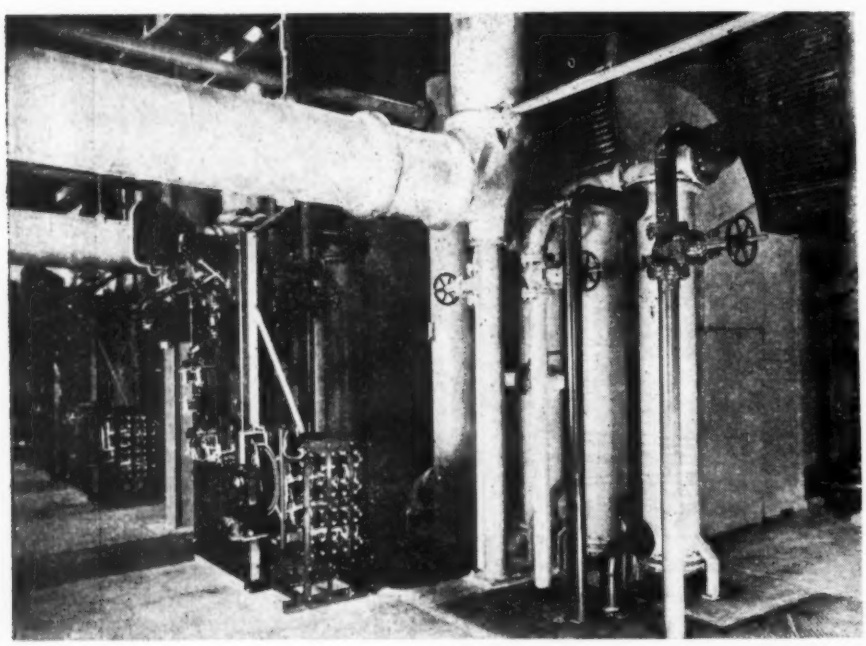


Fig. 5—Auxiliary equipment along building wall at rear of each row of engines includes ventilating blowers, oil and jacket-water coolers and dc switchgear units

The crankcase opens at the side to permit crankshaft removal without disturbing power cylinders. Tension tiebars, plus crankcase covers, close this side opening. All engine bearings are precision type, requiring no hand fitting. An oil pump built in the base, chain-driven from crankshaft, provides full-pressure lubrication.

A common casting, running between the two rows of cylinder heads, Fig. 3, carries exhaust, cooling-water and fuel-gas manifolds, with connections to each cylinder. Individual mechanically operated Pickering-governor-controlled injection valves admit gas at about 25 psi. The Bendix-Scintilla ignition system consists of two low-tension engine-driven magnetos with high-tension coils at each spark plug. An overspeed safety device built into the flywheel operates a switch to ground magnetos and shut unit down.

Engine Auxiliaries

Each engine drives a General Electric 750-kw 645-v 1160-amp dc generator. At this end, a belt-driven Goulds raw-water pump takes suction from the main raw-water circuit, to be described later, and discharges through a Ross vertical oil cooler and two Ross vertical jacket-water coolers, connected in series, to the main raw-water return. The jacket-water pump, on the same bedplate and also belt driven, takes suction from a vertical soft-water storage tank next to heat exchangers, Fig. 5, and discharges through jacket-water coolers and engine.

Intake air can be drawn from inside the engine room, by way of a vertical standpipe with inlet close to the roof truss, or from outdoors. Staynew filters, protected against possible backfire damage by dead-weight relief valves, stand outside building. Filtered air reaches a foundation duct by way of an underfloor line. In each of the four buildings, heat dissipated by engines, exhaust manifolds, piping, etc, amounts to 7.5 million Btu per hr. Engine air intake removes part of this heat; motor-driven American Blower Co fans in the building walls provide balance of ventilation air, which is also filtered. Air volume is sufficient to maintain tem-

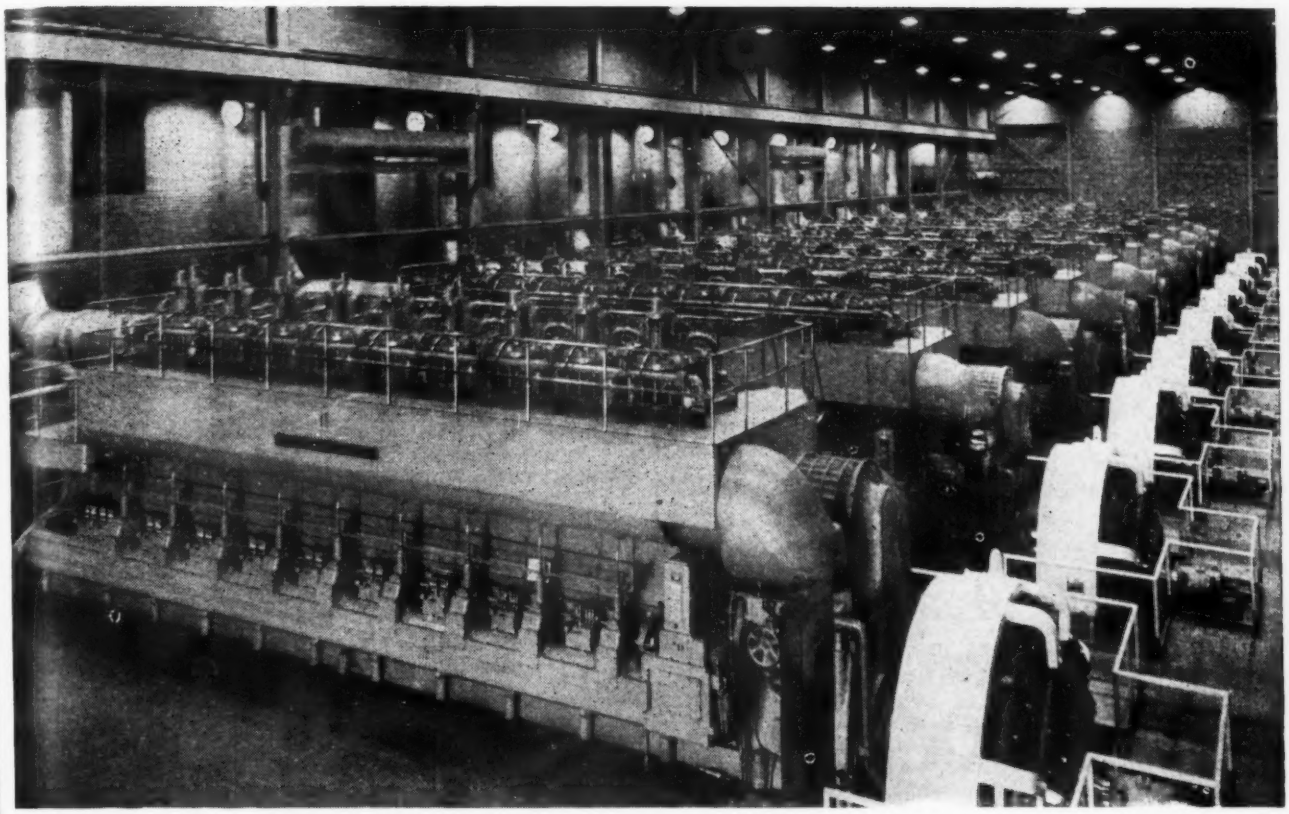


Fig. 6—One of two identical engine rooms each housing nine gas-diesel engines driving 2250-kw dc generators

perature at building center only 10 F above incoming air. Motor-driven roof units furnish supplementary ventilation.

Exhaust manifolds carry horizontally across the aisle at the rear of each engine row, Fig. 5, and rise vertically to Burgess snubbers. A panel on each engine, Fig. 2, mounts Alnor pyrometer, General Electric tachometer, Mercoid safety controls and U. S. Gauge Co pressure gages. Each engine is provided with McCord mechanical lubricators, Cuno lube-oil filters and a lube-oil purifier (44 are Honan-Crane and six are Briggs clarifiers).

In the two Nordberg engine houses, units are arranged in single rows of nine engines each, with an aisle at each end. Fig. 6. Along the wall at generator end stand switchgear, air compressors and ventilating blowers. Other auxiliaries are grouped along the wall at engine rear. Each 9-cyl 21½x29-in. 225-rpm 2-cycle 3600-hp unit drives a 2250-kw 645-v 3490-amp dc generator.

These engines represent latest development of the dual-fuel or gas-burning diesel, stemming from the first unit installed at Lubbock, Texas, in 1936 (See POWER, Sept, 1937, p 515.). Operating principles of this design were described rather fully in POWER, Sept, 1942, p 651. In brief, a 3-stage compressor raises fuel-gas pressure to 1100 psi, discharging to a gas bottle that connects to the fuel-injection valve on each cylinder. A hydraulic actuator times the injection valve. Bosch fuel pumps. Woodward - governor - controlled and driven from camshaft, supply oil pressure to operate actuators. An open fitting with an inside diameter slightly less than that of plunger replaces pump delivery valve and connects by tubing of same diameter to actuator in cylinder head. Actuator plunger lifts fuel-valve lever through a rounded-end link.

Pilot-Oil Injection

A small quantity of pilot oil, about 5% of total fuel input, proves necessary to stabilize combustion. On these engines, nine individual injection pumps, grouped on camshaft housing at engine rear, Fig. 7, supply this oil. This arrangement permits convenient adjustment of pilot oil to minimum required and compensates for wear of individual pump cylinders. Amount of pilot oil remains constant at all loads but pumps connect to regulating shaft to cut off oil supply during starting and stopping. Engines are convertible from gas operation to solid-injection oil burning.

Cross-section, Fig. 8, shows typical Nordberg 2-cycle trunk-piston construction. Blower furnishes scavenging air which enters through valves at right and flows up across cylinder top and then down and out through exhaust ports. Oil-cooled pistons are 2-piece construction; wristpin bolts to bosses in piston trunk. Cooling oil comes from main pressure-lubrication system. Engine structure consists of a cast bedplate, A-frames and individual cylinder castings, bolted together front and rear. Through bolts, running from cylinder heads to bedplate, take all tension stress.

Single-row arrangement of Nordberg engines permits placing auxiliary equipment at both ends, Fig. 9 and 10. To save space, heat exchangers, pumps and piping are grouped in a large trench or semibasement, running entire length of building and partially covered with grating. Engine-driven Allis Chalmers raw- and jacket-water pumps and Blackmer lube-oil pumps are below floor level while Foster Wheeler heat exchangers and Schutte & Koerting oil coolers mount vertically with bases at trench level, Fig. 9. One heat exchanger serves each engine; raw water comes from main circuit, and discharge from exchangers goes to hotwells before return to the cooling towers.

Intake equipment stands in brick chambers between wall shown in Fig. 9 and exterior wall. Outside air enters chambers, passes through Staynew filters and Burgess snubbers and then through an underfloor duct to Roots scavenging blower at the engine's generator end. Exhaust manifolds cross

rear aisle and connect to Burgess snubbers, Fig. 6 and 9.

Individual engine control panels at generator end, Fig. 7, carry Brown multipoint pyrometers, U. S. Gauge Co pressure gages, Viking safety controls and a Klaxon alarm. Horn warns of trouble; signal lights indicate its source. Each engine is equipped with Manzel lubricators, Commercial Filters Corp lube-oil filters and a Honan-Crane lube-oil purifier.

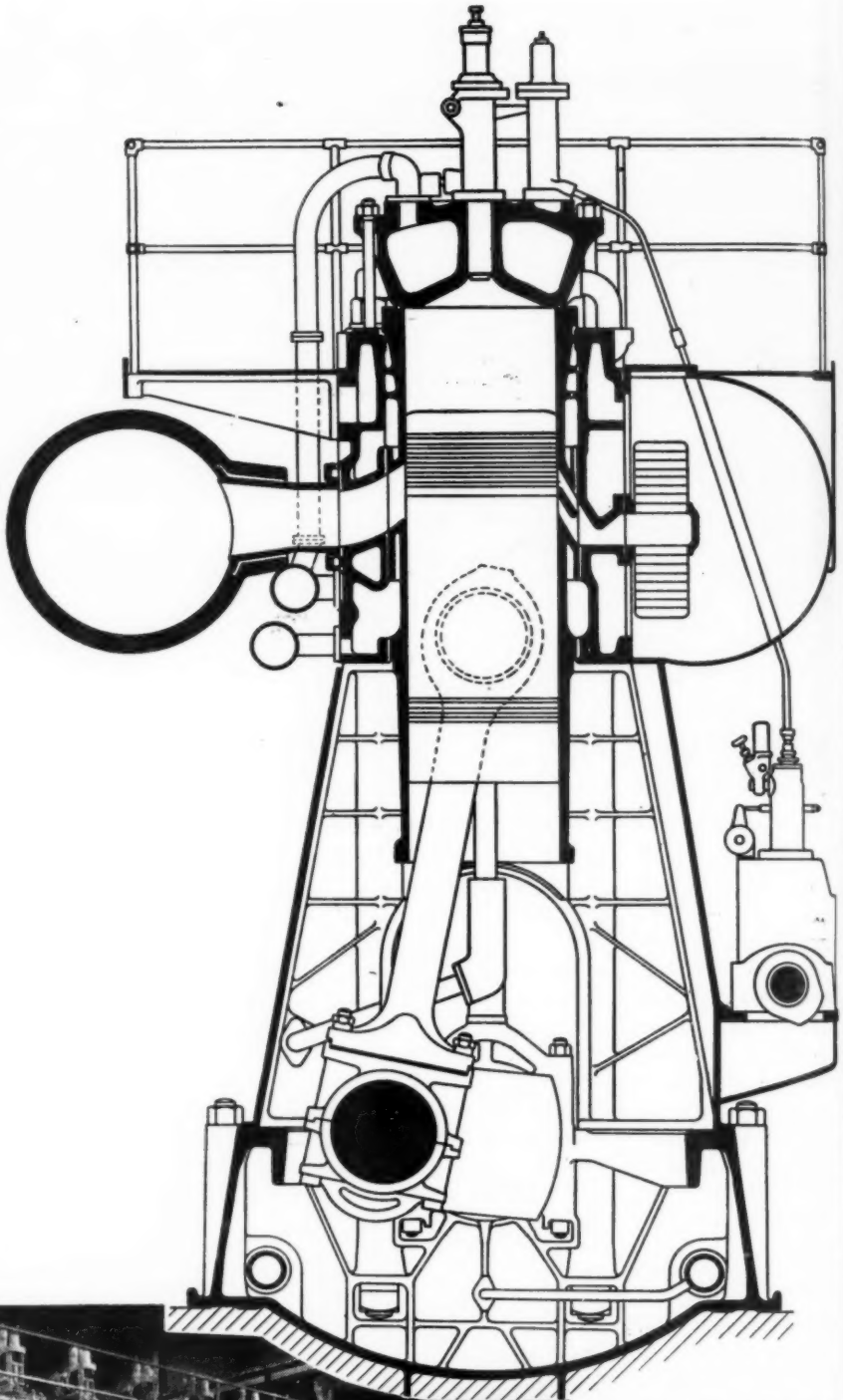
General plant views, Fig. 1 and 6, and auxiliary-aisle photos, Fig. 4, 5, 9 and 10, show how, in both engine plants, skillful layout avoided complexity of piping that might be expected with such a large number of units. As far as possible, prefabrication and field welding speeded erection. All piping is color coded. Most piping was supplied by National Valve Co, and valves by Crane Co and Walworth. A similar orderly layout characterizes busses and electrical wiring.

Starting-Air Systems

To supply starting-air systems, each engine house has a 2-stage 350-psi Gardner-Denver compressor driven by a Westinghouse motor and a similar standby unit driven through a Twin Disc clutch by a Continental gas engine.

Low-cost natural-gas fuel comes, by pipeline, from northern Louisiana and nearby southern Arkansas. The specific gravity is 0.62 and average heating value, measured by Cutler-Hammer recording calorimeter, about 980 Btu per cu ft. Designers considered introducing an odorant into the gas, for safety, but this precaution proved unnecessary.

After a careful survey of available sources, a fuel oil having the following



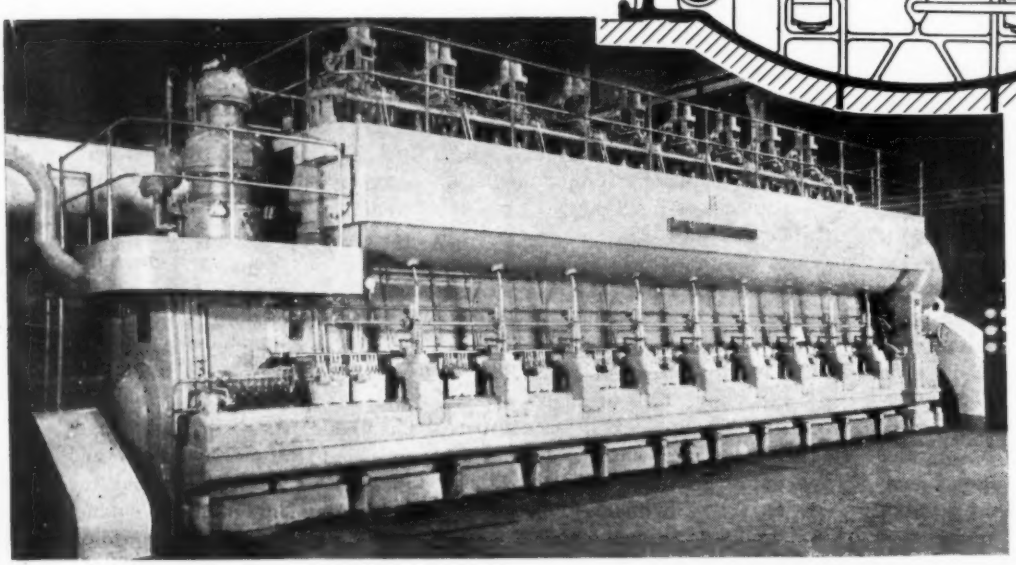
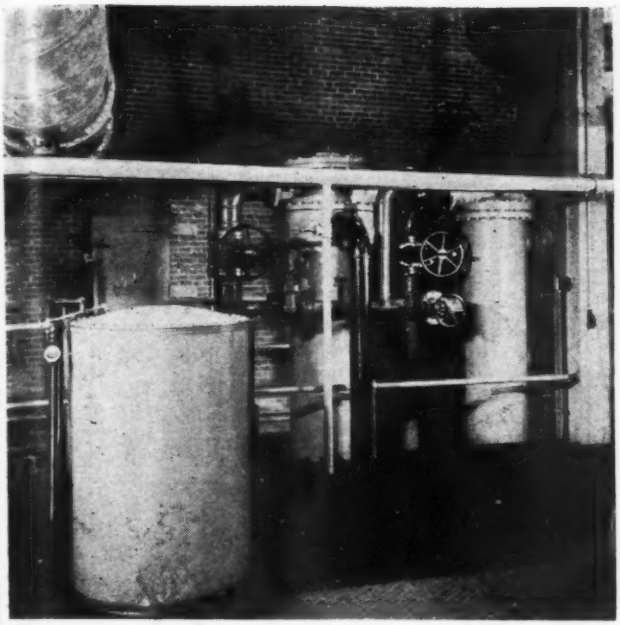


Fig. 7—Operating side of 3600-hp 9-cyl 225-rpm 21½ x 29-in. 2-cycle gas-burning diesel, showing pilot-oil pumps at left, actuator pumps mounted on camshaft housing, and individual engine control panel at extreme right. Fig. 8—Cross-section shows typical Nordberg construction with trunk piston. Mounted on camshaft housing at right, standard Bosch pump supplies oil pressure for actuator plunger, which lifts fuel valve admitting high-pressure gas to the engine cylinder



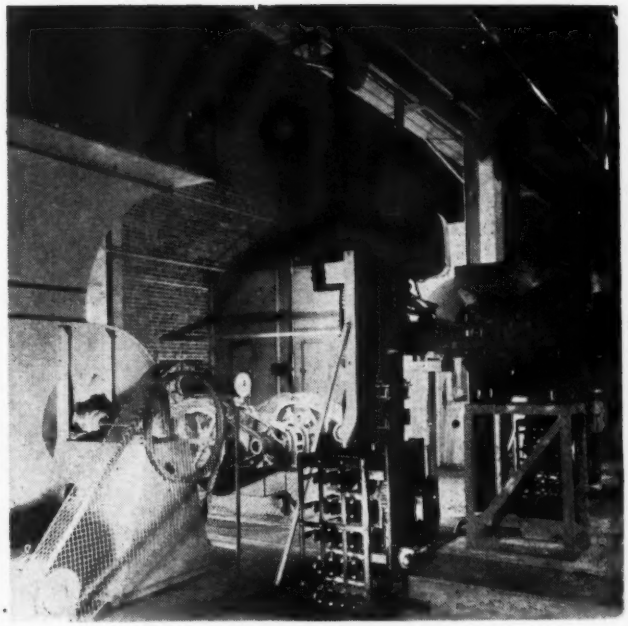


Fig. 9—Behind Nordberg engines, a large trench or semibasement, partly covered by grating, runs entire length of engine room. Belt-driven raw- and jacket-water pumps, lube-oil pumps, heat exchangers and piping are in this section. Photo shows, left to right, individual lube-oil purifier, oil cooler and jacket-water heat exchanger. Exhaust manifold and snubber are visible at upper left; brick chamber behind wall at rear houses air passageways, filters and intake snubbers. Fig. 10—In aisle at generator end of engines stand switchgear and ventilating blowers. At center rear is starting-air compressor

typical analysis was selected for pilot injection on Nordberg units:

Viscosity, SSU at 70 F	36-37
Viscosity, SSU at 60 F	37.2
Firepoint, F	200
Flashpoint, F	185
Pourpoint, F	0
Sulphur, %	0.25

Pilot and lubricating oils are stored in a number of outdoor steel tanks.

Plant water supply comes from the Ouachita River, not far away, where a large pumping installation raises water to elevated storage tanks for gravity flow to plant. Each engine plant is served by a 12-cell induced-draft Water Cooling Equipment Corp cooling tower, each capable of cooling 21,280 gpm of raw water from 115 F to 90 F at 75-F wet bulb. Makeup requirements run approximately 2000 gpm. Towers are located so that drift, under prevailing winds, is away from plant proper.

A pump house adjacent to each cooling tower contains three 10,000-gpm 585-rpm Allis-Chalmers centrifugal pumps, driven by 100-hp motors, one unit serving as a spare. Pumps discharge, at a maximum head of 33 ft, into a raw water loop across which heat exchangers and oil coolers connect. Pipe size and layout is such as to keep pumping power to a minimum. Water circulated in engine circuits is zeolite treated to avoid scale formation in jackets and heat exchangers. This water system with its individual raw- and jacket-water pumps, Texrope-driven from the engines, insures that each unit receives proper cooling and that water circulates when an engine starts.

Electrical hookup divides into two parts: dc for pot lines and ac for plant auxiliaries. On dc side, individual positive and ground circuit breakers, of high-speed open design, connect each engine-generator, Fig. 5 and 10, to plant busses that connect, in turn, through an outdoor bus structure, with silver conductors, to pot lines. Normally, each engine plant serves an individual pot line; mercury-arc rectifier equipment, supplied by high-tension lines, serves two remaining pot lines. Tie busses, with sectionalizing breakers, connect between pot lines so that any one of the four can be supplied from either engine plant or from rectifiers.

Use of ac for auxiliaries, made possible by transmission-line interconnection, speeded securing of motor equipment. Motor-generator sets protect against loss of outside ac service.

OPERATING SCHEDULE

	Nordberg (2250 kw)		*Cooper-Bessemer* (750 kw)	
	No.	*Kw*	*No.*	*Kw*
Total capacity.	18	40,500	50	37,500
In operation...	15	33,750	45	33,750
In reserve.....	2	4500	4	3000
Under overhaul.	1	2250	1	750

Normally, each engine plant serves one pot line, with average demand 33,500-kw.

Electrical control for each engine plant centers in a bay or corridor connecting the two buildings that comprise each plant, forming the base of a large U. Each bay houses a General Electric panelboard with voltage-regulator, generator-control, tie-breaker, ac-service and auxiliary-feeder sections.

Operation of engine plants has been thoroughly systematized. Schedule on this page shows how units rotate in service to insure output to meet pot-line demand while providing reserve capacity and allowance for mechanical overhaul. Maximum demand is 67,000 kw. annual load factor averages 94%, and annual net output approximates 550 million kwhr.

Plant personnel totals 130 for all shifts. This includes an office staff of 4 (plant supt, asst and two clerks) and a maintenance crew of 21 (chief, 4 mechanics, 8 asst mechanics, 8 helpers). On a basis of three 8-hr shifts and relief, operating force includes 8 chief operators, 16 operating engrs, 8 swbd operators, 32 asst engrs, 32 oilers, 4 pump operators and 5 laborers.

Experience at this plant indicates that, where cheap fuel is available, internal-combustion-engine power proves an acceptable substitute for hydro energy in aluminum production and a method of generation that may grow in importance as number of good hydro sites declines and development cost increases. Overall plant heat rate is approximately 14,000 Btu per kwhr.

Shipmakers' Jigs Speed Piping Assembly

By C M DENTON, *Piping Engineer, California Shipbuilding Corp*

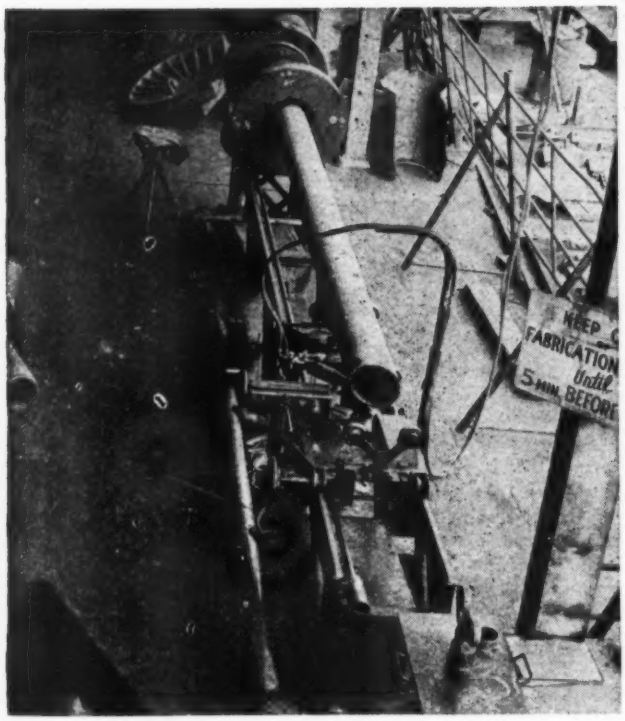


Fig. 1—Machine for flame-cutting pipe up to 12-in. diameter at any desired angle. Torch automatically bevels cut edge. Piece of 8-in. pipe and torch in position for angle cut

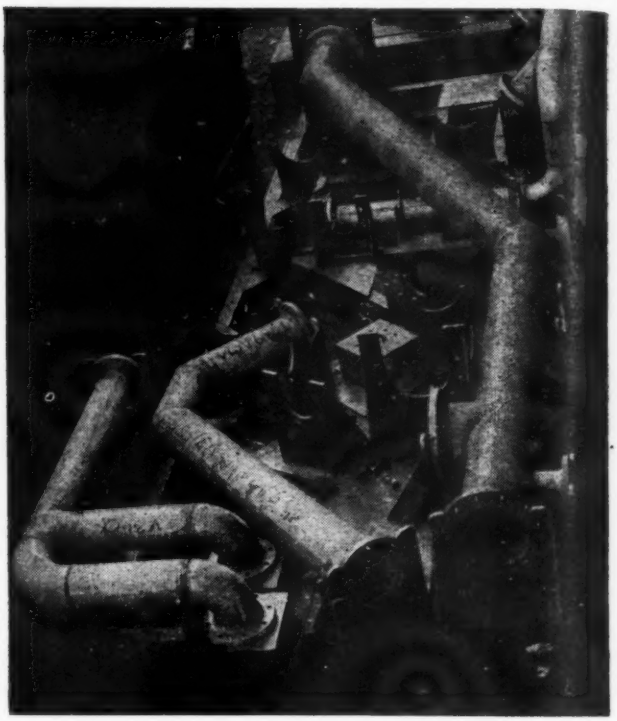


Fig. 2—Jig elements for condenser circulating system with 10-in., 8-in. and 6-in. sections in place. Unused face plates receive other assemblies of the same system for welding

► EXCEPT FOR the standardizing of ship design, which makes possible use of prefabrication methods, not only for the hull but also for accessory construction such as piping, American yards could never have built the huge merchant fleet constructed in the last three years.

Suppose, for example, that the piping of a Victory ship, some 50 separate systems with a total length of eight miles, were installed by the traditional method of marine pipe fitting—bending the pipe to templates lifted from the ship and then taking each component aboard the hull for final fitting —instead of fabricating the entire system in complete subassembly portions, standardized and interchangeable, as we now do. The war simply would not have waited for us to build ships by the old one-piece-at-a-time method.

Time saved by prefabrication is indicated by a comparison of the 225 days required by our yard to build its first Liberty ship, involving 120,000 man-hours for piping alone, with the average time of 20 days attained by the spring of 1942. At that time, with 14 ways and 10 outfitting docks, we were delivering 18 such ships a month, and the man-hours required for piping were approximately 25,000.

For prefabrication, each of a ship's piping systems is broken down into subassembly components, called spools. These are fabricated individually, and repeatedly, for a number of ships. Each spool is welded and tested with the flanges attached, so that piping work aboard the hull becomes little more than a process of final connection.

Job Starts with Drawings

To do this, a detailed drawing of each spool is made, containing all information required, the bill of material, flange specifications, bends and angles, lengths, and the code number by which the spool is designated on the erection schedule. From three to four thousand such drawings are required for a typical ship.

Assuming that a supply of the various spools of pipe has been fabricated with absolute precision, assembly of the requisite components should produce a piping system that would exactly duplicate the theoretical system on the master plans. However, errors do creep in, and since the assembly of the piping system proceeds progressively, as the assembly of the hull proceeds, these errors might become cumulative and require large adjustments that would defeat, to a large degree, the purpose of prefabrication.

It is therefore necessary that control points be established, and that the effect of minor errors be curbed progressively as construction proceeds. This is a basic requirement, not only for piping but for construction of the hull and installation of all machinery. This is done by establishing reference lines parallel to the longitudinal center line of the ship, in each of several equi-spaced horizontal planes.

These reference lines are located on the bulkheads and shell plates of the ship, as construction proceeds, by the use of transits, and are thereafter used as reference lines for subsequent construction and installation of machinery. On the detailed engineering drawings of each pipe spool, location of connecting points with respect to these reference lines is specified. Minor remaining irregularities in the connection of pipe spools are eliminated by leaving

Prefabrication of piping for standardized ship power plants has greatly reduced man-hours of actual assembly. Perhaps some of the ideas can be turned to useful account for stationary-plant construction

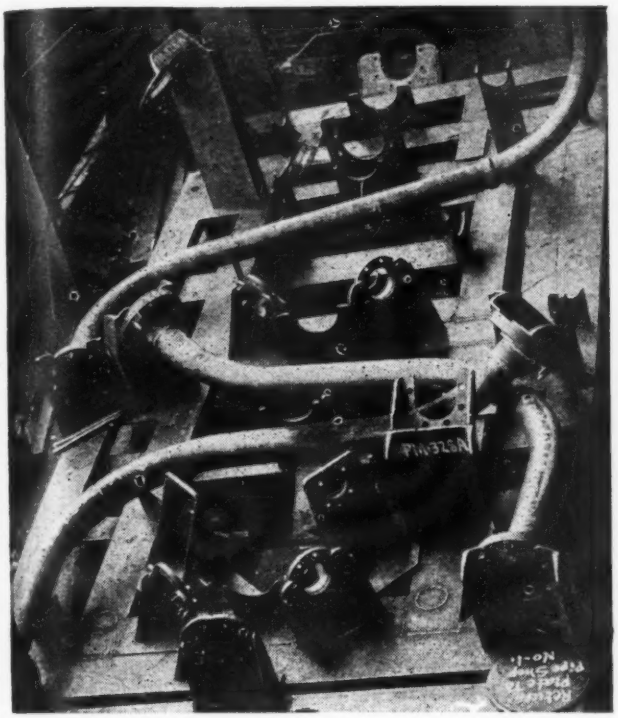


Fig. 3—Part of a ship's 400-psi 720-F main steam piping on a welding jig. Note compound curvature and angle of flange faces as required for assembly within the ship's hull

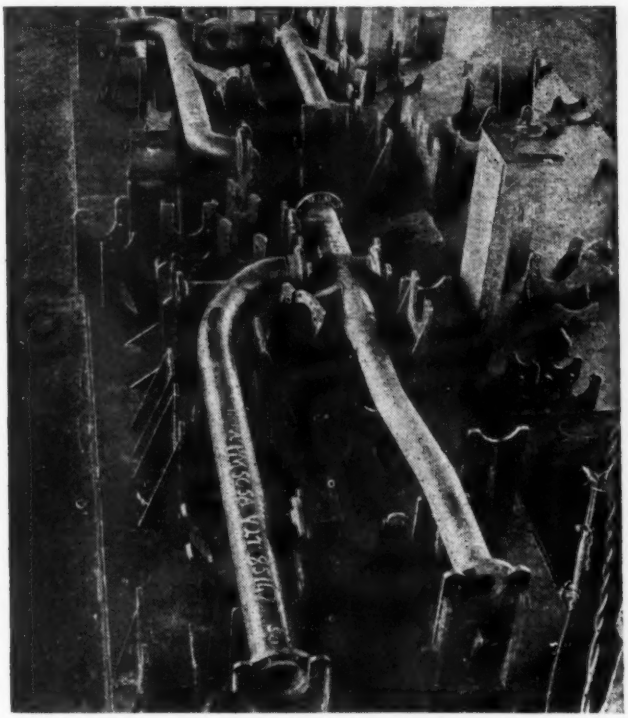


Fig. 4—Exhaust-steam piping requires welding of saddles at various angles, which would involve the toughest kind of position welding without jigs to give correct precision support

one or two flanges loose for welding to pipe at time of final assembly.

Actual fabrication of individual pipe spools is a line-production process. The pipe yard is located at one end of the pipe shop and material is moved to and through that shop by overhead cranes. At the first station on this line are power pipecutters which cut pipe to required lengths, thread and groove it if necessary. After being cut to length, component pipe runs are curved as necessary, on hydraulic bending machines. Before being moved on to welding stations, lengths and angles of the elements are checked.

Welding, the most critical and important step, is done on welding jigs, shown by photographs, which are rigid, skeleton work tables, of some 10x20 ft. Accurately located positioning plates to which terminal flanges of each pipe spool can be bolted are welded to the structural steel members of the table. Also welded are supporting cradles in which pipe runs rest while they are being assembled. Face plates and cradles are provided for all branches.

Generally all the jigs for one piping system are located on one table. One vertical face plate, at one end of the jig frame, may serve as the terminal location device of several spools, the various cradles and other face plates being located at the point on the jig frame made necessary by the shape of the several spools worked on that jig. These assembly fixtures permit spools of pipe to be assembled with a high degree of accuracy, the variation in over-all length of spools 20 ft long being not more than $\frac{1}{8}$ in.

Use Welding Jigs Two Ways

Welding jigs may be used in two ways, for pre-assembly and for final assembly of a pipe spool. In pre-assembly, the components are located with respect to each other, then tack-welded and removed to a work table for final welding. Because welding is easier when pipe can be rolled on the table as the weld proceeds, all elements whose shape permit such handling are handled in that manner before being welded together, or tackwelded, as the case may be, on the jig. After being welded, each spool of pipe is checked, tested and marked, and moved to a storage area to be held until needed.

Completed pipe spools are withdrawn from storage on an automatic schedule keyed to the erection sequence on each hull. When such a spool arrives at the hull, there remains only the problem of hoisting it aboard and connecting it, or of installing it in one of the hull subassemblies, of which it becomes a part. Location of a spool of pipe is shown on an erection drawing, on which the precise location of each spool with reference to the datum lines previously described is specified.

Brackets are specified by these drawings, and are, insofar as possible, of a standard type designed so that the only adjustment necessary as the pipe is being hung is to trim the length of a leg as required. These standard brackets are fabricated in large quantities on a punch press, and withdrawn from stores as required on the job just as are studs, bolts or any other standard commodity.

We are proud of our piping record at Calship, and the more so because it is a team job of mass production that involves cooperation and coordination of all departments, without which there would be fewer ships now at sea.

A Charge System For Power Services That Works

S Senko, powerhouse engineer, meters the Btu and kwhr going to factory units and bills each department according to the amount used and the total over-all cost

Powerhouse stack and flue-gas breeching designed for six 6500-sq.-ft. boilers. Adjacent substation feeds the boilerhouse and Personal Products Corp building

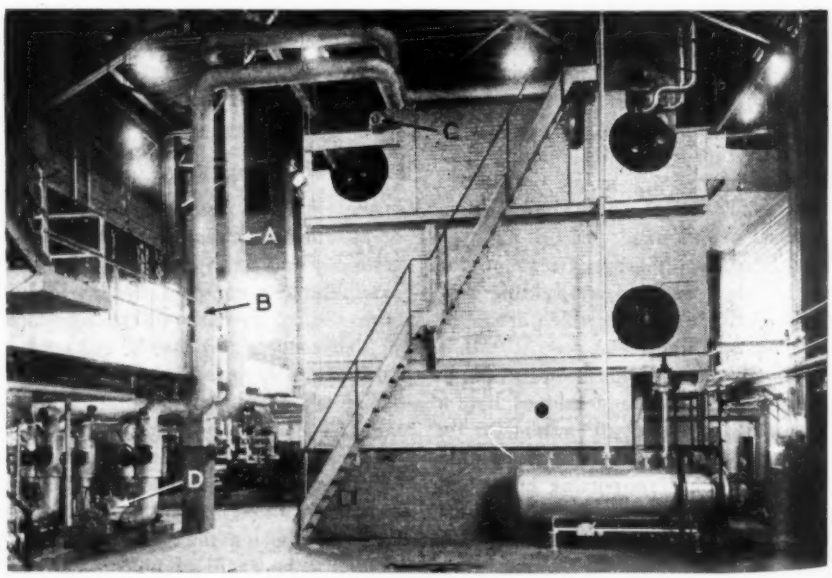
► The Personal Products Corp purchases electricity from the local utility and furnishes hot water for its own space and process heating as well as for the Industrial Tape Corp. A main substation connected to the utility's 26,000-v line contains the necessary 26,000/4150-v step-down transformers, billing meters and feeders that supply unit 4150/440/110-v substations at each point of use. Motor load is supplied at 440 v and lighting at 110 v. A synchronous motor driving the main air compressor, together with static-condenser units strategically located, helps maintain good system power factor.

Service Meters

Each building unit has meters for electricity, hot water—temperature and flow, drinking water, sanitary water and filtered water for process. Drinking water comes from the municipal distribution system and is metered on the incoming line. Utility rates for power metered at the main substation include a demand charge that we reduce monthly to cost per kwhr used. We add this sum to the billing rate per kwhr to distribute the demand charge equitably. After arriving at the total cost of purchased services we charge each factory unit at the purchased rate for the amount metered at its building. Cost of quantities unaccounted for, such as line and transformer loss, is divided equally among users.

Filtered sanitary and process water and hot water for space and process heating come from the main filter and boiler plant. Operating and overhead cost figures determine the rates at which metered services are charged.

For instance, hot-water flow is metered at each building and charged for on a Btu basis. Each building has an entrance and exit water-temperature recorder and flowmeter. Number of Btu extracted is the difference between entrance and exit temperatures, times the weight of water flowing. When temperature curves are wavy, chart



Boiler arrangement showing: (A) system return, (B) system feed from boiler drum to high-head pumps (D), (C) small drum furnishing auxiliary steam take-off

area is planimetered to get an average value. Chart recordings are worked out daily for lb of water and Btu extracted and these sums entered in the plant log book.

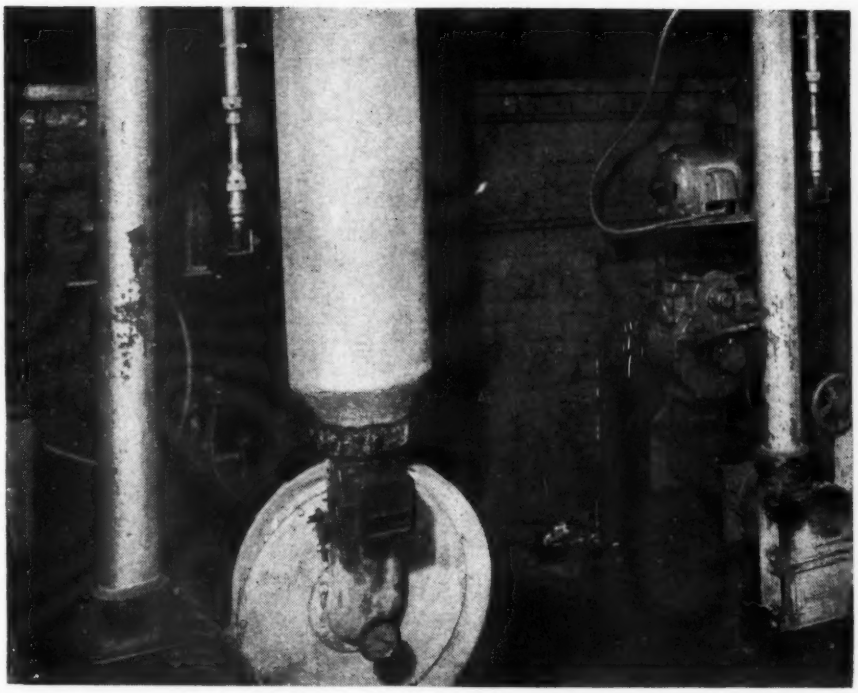
Supertherm System

Hot water for space and process heating is supplied by a Supertherm system installed by the J O Ross Engineering Co. with R G and W Cary as consulting engineers. This system removes water at saturated-steam temperature from a standard industrial boiler, circulates it through two closed-system zones by specially designed pumps and returns it to the boiler for reheating. A tempering line at the boiler permits bypassing a quantity of return water to regulate outgoing water temperature. Only marked rearrangement in the boiler over that for regular steam supply is to provide take-offs on the main drum for feed and return water with nozzles submerged below water level. A small drum supplies steam for soot blowing and to operate several emergency pumps. The 6500-sq-ft boiler operates at 180 psi and 375 F; its 200% rating is 43.5 million Btu per hr. The system requires no traps, reducing valves or separators.

Water is circulated through the boiler and two zones by four 400-gpm motor-driven pumps. Because the pumps run continuously, circulating lines have 1-in. bypasses at their far ends to protect against complete shutoff. Brown air-operated controllers regulate the water flow to various heating coils. Pumps on the low-head zone operate at 45 psi above boiler pressure and the high-head zone ones at 90 psi higher. Water entering pumps from the boiler has uniform temperature, but water returning from the two zones has dissimilar temperatures depending on amount of heat removed in different processes.

Based on an 83-F drop the low-head 8-in. pipeline is rated at 64 million Btu per hr. The high-head 10-in. line can supply 110 million Btu for the same temperature drop. Running underground for 2200 ft to a metering pit the 10-in. line feeds the Industrial Tape Corp through 2200 ft of 5-in line capable of supplying 19 million Btu per hr at 83 F. drop. Terminal of 10-in. line also provides for five future connections.

Summer load approximates 13 million Btu and winter load 26 million Btu per hr. On a cu-ft basis, one cu ft of 375-F water yields 8900 Btu when cooled to 212 F. Steam at the same temperature yields 360 Btu per hr per cu ft.



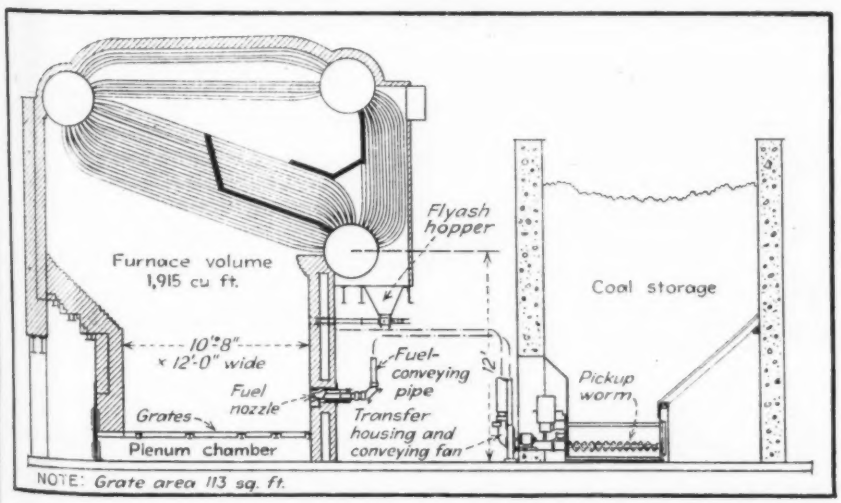
Control adjusts coal feed by raising or lowering the motor's hinged base, which causes an automatic V-belt pulley speed changer to narrow or widen its groove

The Erie City 3-drum boiler set with its mud drum 12 ft above the floor line was originally fired with Todd pressure-type oil burners installed in the furnace front. Furnace floor and side walls are air cooled. Cooling air, after flowing through the setting, enters the inlet of a Sturtevant forced-draft fan.

Oil to Coal

Shortage of oil necessitated an early conversion to coal. Its handling is an annoying problem for a plant of this size because of the large expenditure for coal conveyors and bunkers. Our solution was to truck from remote storage to a suitable inclosed 60-ton bunker behind the boiler room.

We purchased an Iron Fireman pneumatic bin-feed stoker to solve the coal-handling problem because the feeding mechanism could be placed within the bunker and coal conveyed to and fired through the rear furnace wall. Another reason for our choice was this stoker's low power requirement and its ability to burn the wide range of fuels with minimum ash fusion. It also offered the advantage of accessibility because the rear boiler wall is only five feet from bunker retaining wall. Stoker has three pick-up sections within the bunker with corresponding conveying

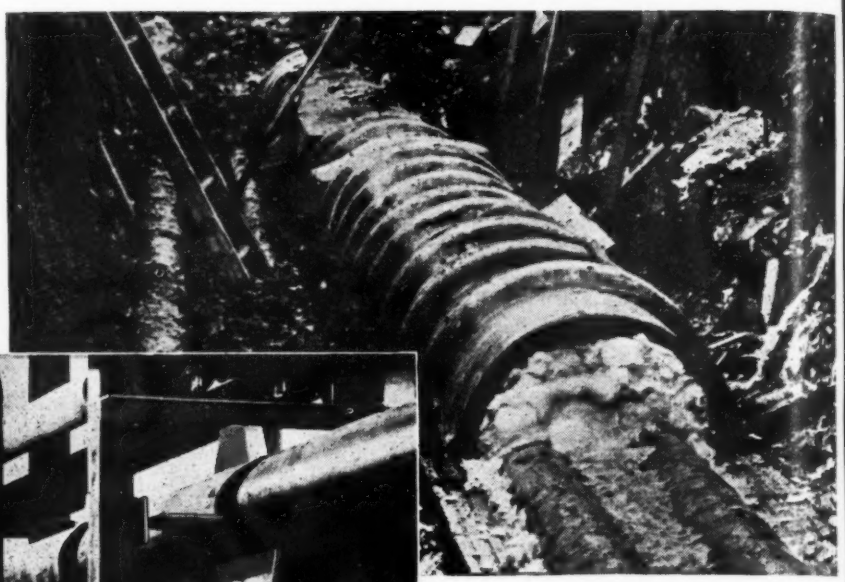


Flyash from the last pass of the boiler is injected into the furnace by an air-operated venturi nozzle. Flyash from the stack is also returned to the furnace

fans delivering the coal to the furnace.

Forced-draft fan originally used with oil firing now supplies air to the undergrate chamber divided into two longitudinal sections. This permits shutting the air off one section during cleaning periods while the other section is in normal operation. A W Cash combustion control regulates the uptake damper, coal feed and undergrate air.

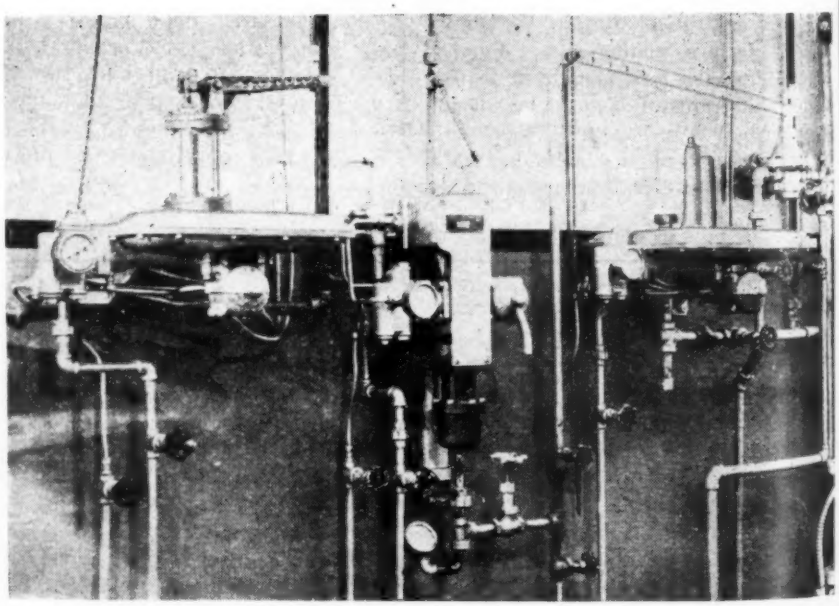
Flyash collected in a hopper below the mud drum is reinjected into the furnace by a venturi nozzle supplied with air under pressure. A Whirlex flyash arrester, inside the radial brick stack built by the Alfonse Custodis Co. collects flyash that is also returned to the furnace.



Above—Two 5-in. all-welded lines, 2200 ft long (supply and return) incased in tile with glass-wool insulation, feed one building from 2200-ft main

Left—Wings, solidly welded on the pipe at 90-deg positions, ride against substantial frames and prevent bending strains on the expansion joints

Below—Complete control includes (left to right) windbox air-pressure regulator, master regulator that adjusts coal feed and stack-draft regulator



The coal-burning system has operated since December, 1942, without loss of the unit's availability, an extremely important fact in a plant depending on a single unit. Boiler efficiency averages 79.5% over a 12-month period.

Water for process and sanitary purposes comes from a one-million gal-per-day-filter plant now operating at 350,000 gpd. Water leaving the plant has zero color, turbidity, taste and odor but has 40 ppm of hardness and a pH of 7.3 to 7.8. Raw water entering with 5-ppm turbidity, 75- to 125-ppm color, 28- to 30-ppm hardness, 12-ppm alkalinity and a pH of 6.0 is treated with aluminum sulphate, soda ash and chlorine before coagulation.

After coagulation the water passes through a 12x15-ft gravity sand filter to the clearwell. Pumps feeding the distribution system force the clearwell water through two 350-gpm activated charcoal filters and zeolite softeners to supply the demand. Pumps operate on control actuated by distribution pressure.

A small laboratory contains complete equipment to test both filtered and boiler water. Boiler water is maintained at zero hardness, 70 to 80 ppm phenolphthalein alkalinity, 150 to 160 methyl-orange alkalinity, pH 10.8 to 11.0 and residual sodium sulphite 25 to 30 ppm. Daily tests show what adjustments are needed.

Semi-Outdoor Boiler Plant Supplies Steam for "100 Octane Plus"

Richfield Oil Corp's recently completed addition at Watson Refinery, Los Angeles, boosting aviation fuel to 1000% of 1940 output, includes high-pressure boilers, extensions to water-supply and treatment systems, revision of electrical facilities

A NEW BOILER PLANT, water-supply extensions, and revisions and additions to electrical facilities form important parts of the new "100-octane-plus" refinery program recently completed at Richfield Oil Corp's Watson Refinery, Los Angeles. This $20,000,000 project culminates a continuous expansion which has, without interrupting production, boosted the aviation-fuel output by 1000% since 1940 at this, the first refinery in southern California to manufacture 100-octane gasoline.

Following former practice, the boiler plant furnishes steam for process and auxiliary drives, and Southern California Edison Co supplies electric power. Studies to determine the most economical steam pressure and temperature for the new plant had to consider interconnection with existing 150-psi equipment and inclusion in the new refining process of reboilers and heaters that would either require steam at considerably above 150 psi or the use of a heat-medium heater. Designers decided on 600 psi, reduced to 450 psi for high-temperature reboilers and to 150 psi.

Dual Draft Equipment

Each of the two 600-psi 750-F 300,000-lb-per-hr gas-and-oil-fired integral-furnace boilers has two complete sets of draft equipment—two Ljungstrom air heaters, two forced-draft and two induced-draft fans. Use of one set permits operation at about 75% of boiler full-load rating, while the other set is down for inspection or overhaul. Under these conditions, the other boiler picks up extra load. For the present, new boilers operate on block load.

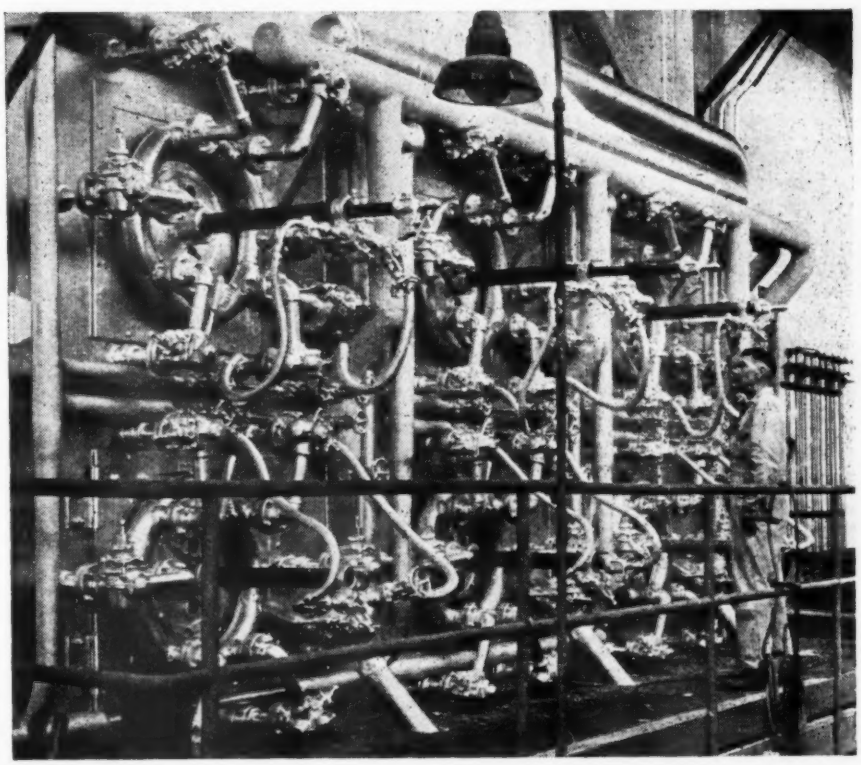
All boiler auxiliaries and some refinery pumps are steam-turbine driven. Turbines for boiler-feed pumps and forced- and induced-draft fans take steam from the 600-psi header and exhaust at 150 psi. Steam at 600 psi also goes to 3200 hp of turbine drives on cooling-tower circulating pumps and blowers. These units exhaust into the 150-psi refinery system. Other pump turbines operate on 150-psi steam and exhaust into the 25-psi system, while preheater turbines operating at the same pressure exhaust into the 15-psi steam main to the softeners.

High-pressure steam headers from which auxiliary drives receive steam are fed from both ends and valves between each takeoff permit isolating to overhaul valves and regulators of any pump. All turbines have individual safety releases for protection should pressure in the 150-psi header become dangerously high. There is a pressure-reducing and desuperheating station, automatically controlled, for each boiler, each large enough for total load.

A large part of exhaust steam goes to heating and process, and pressures maintained in different areas depend on temperature requirements of individual processes. Thus there are 40-, 30- and 25-psi exhaust systems. A pilot-operated reducing valve feeds steam from 150-psi header to 25-psi if there is a deficiency for feedwater heating, and two 12-in. multiport relief valves permit exhaust to atmosphere if there is an excess.

Boiler blowdown goes through two flash tanks, one connecting to the 150-psi system and the other to the 25-psi. Wherever line location permits, traps on the 600-psi header discharge into the 150-psi line and traps on the latter discharge to condensate-return system.

Actually, there are two condensate-return systems. One collects returns from all heaters and traps operating on high-pressure steam. This condensate is practically oil-free and goes to a 10,000-bbl storage tank, for use in high-pressure boilers. The second system



Combination gas and oil burners fire new 600-psi 750-F 300,000-lb-per-hr boilers

collects condensate from heaters operating on 25-psi exhaust, which comes mainly from reciprocating pumps and contains oil. This condensate goes to the old boilerhouse, where it is sponge filtered before being fed to l-p boilers.

Photos below show semi-outdoor construction. A brick-and-concrete structure houses boiler fronts, firing aisle and pumps. The rest of the boilers, fans, and pressure-reducing and desuperheating stations are outside. In designing the plant, Lummus Co engineers kept operating convenience in mind and arranged steam piping so that all valves and regulators can be reached from the floor. All pumps, except boiler fuel-oil units, stand in a straight line in the pumphouse, a lean-to structure extending across boiler fronts.

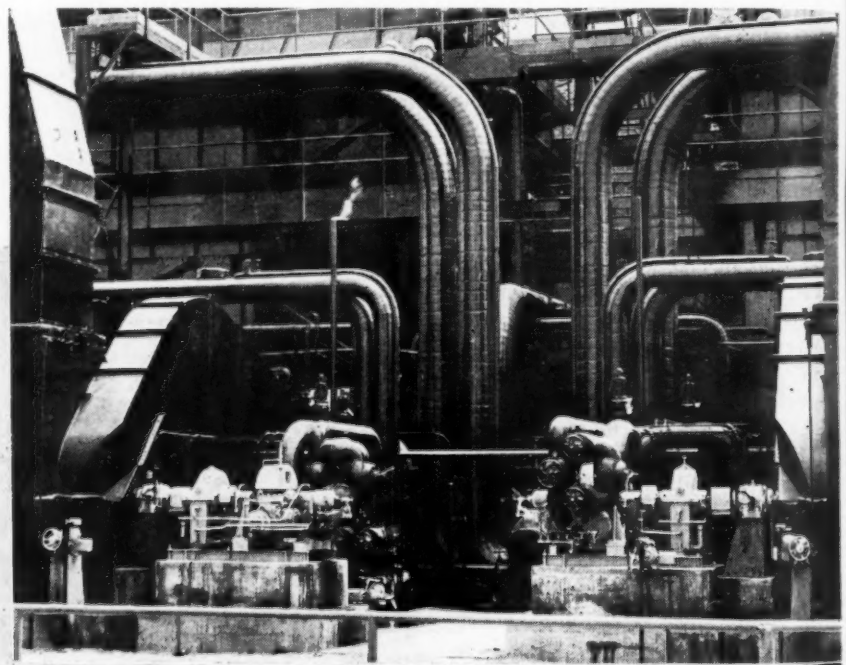
Refinery water supply comes from wells on the 360-acre grounds. There were five producing wells before the expansion program; two more have since been drilled, each having about 1700-gpm capacity. Water shows only 3 gr per gal hardness. All wells discharge into a reservoir adjacent to the fresh-water pumphouse, starting point for three complete water systems. The 125-psi high-pressure system serves only for fire and pressure-vessel testing. Two 2800-gpm pumps maintain 65-psi in the low-pressure system. One, motor-driven, runs continuously and the other, turbine-driven, comes on automatically in case of power failure and whenever needed to maintain pressure. Water from this system serves as makeup for cooling towers, for gland cooling and for boiler feed. The third system, completely separated from the others, furnishes drinking water.

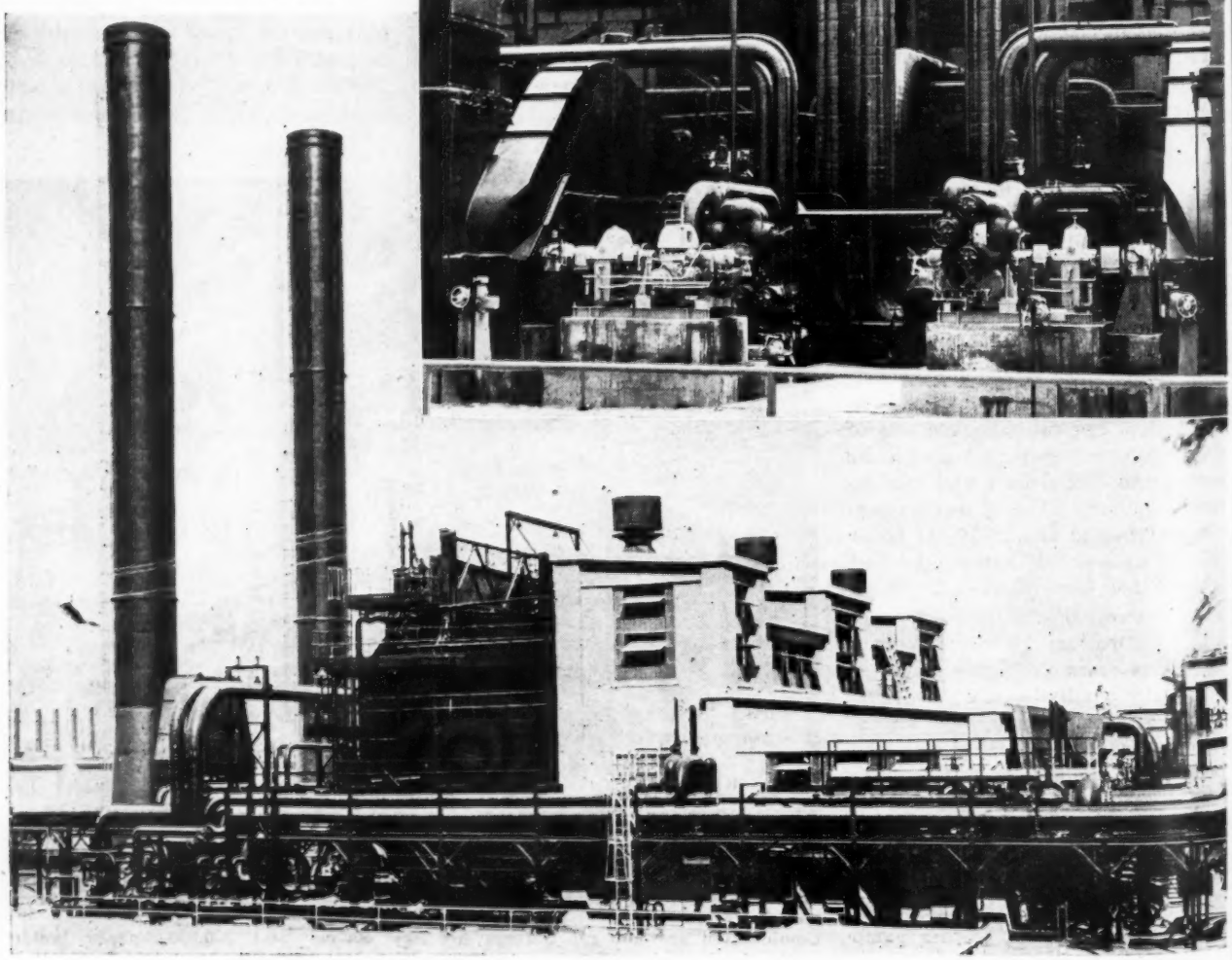
Water for boiler feed runs low in hardness and dissolved solids, except sodium bicarbonate and silica, which run relatively high. In the hot-process softener, use of dolomitic lime and sludge recirculation provide a high concentration of magnesium hydroxide to remove silica by absorption. Silica is reduced from 30 to 5 gpm.

Adding gypsum reduces boiler-water alkalinity by converting bicarbonate to sulphate, which does not hydrolize to give caustic soda. Amount of gypsum may be adjusted to give required sulphate-carbonate ratio, and gypsum offers the added advantage of precipitating CO_2, which would otherwise be liberated with steam to cause corrosion. Although softener deaerating equipment is guaranteed to lower oxygen to 0.005 cc per liter, sodium sulphite is injected into feed-pump suction to make doubly sure that no oxygen enters boilers. Treated

(Right) **Boilers, pressure-reducing stations, fans, and desuperheaters are outdoors. View shows weather-protected piping, turbine-driven fans, and ducts**

(Below) **General view shows brick-and-concrete structure over boiler fronts, firing aisle and pump room; outdoor equipment; part of 400 miles of piping**





water leaving the softener still contains 15 ppm of $CaCO_3$ and to remove this hardness, hexametaphosphate is added to give 40-50 ppm of PO_4 in blowdown.

Return condensate and raw well water enter separate softener compartments. Raw water requires chemical treatment as well as deaeration; return condensate needs only deaeration.

At one end of the chemical storage and mixing building stands a complete laboratory, equipped to make tests on raw and treated water, blowdown and condensate. Cooling-water control is also directed from this laboratory.

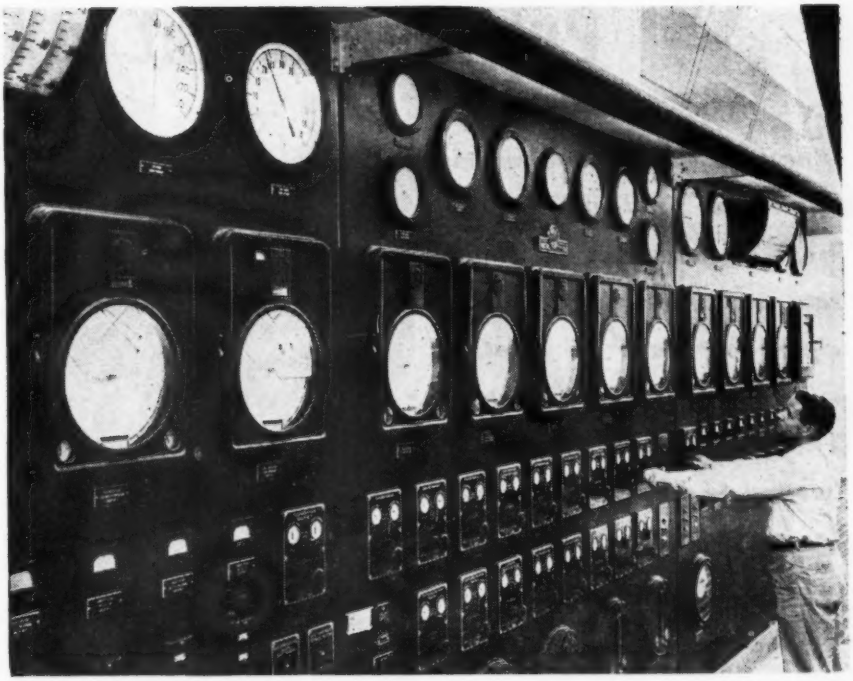
Electrical Distribution

Electric power for the previous refinery load of 9200 kw was supplied at 2300 v on secondary side of 11,000-v transformers. A rearrangement of power supply meets present total load of 12,000 kw. The power company now delivers at 11,000 v to the main refinery substation and two others strategically located in the plant area. Three sources of supply, each relay protected, give the refinery a high degree of protection against power failure.

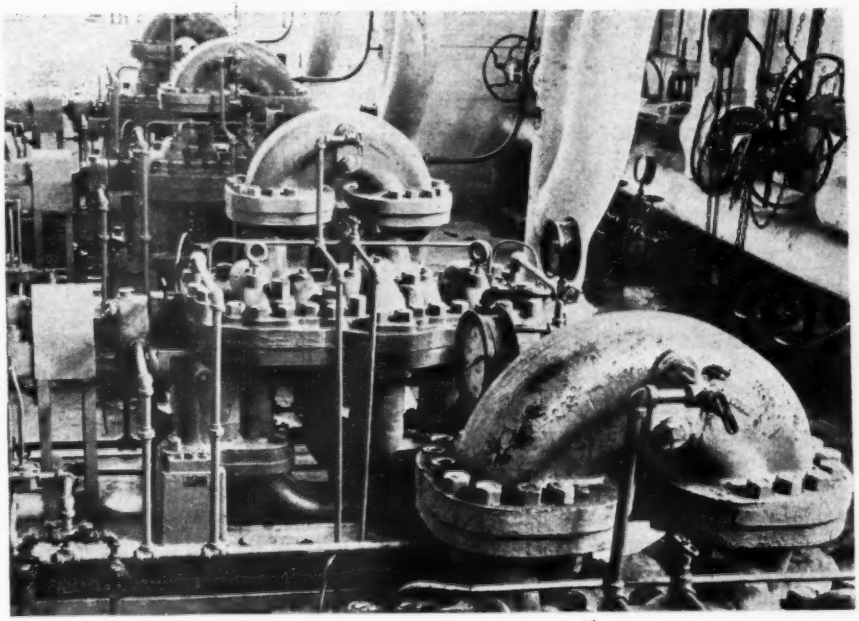
Main transformer bank and distribution center still feed the old part of the refinery at 2300 v. Three new substations serve the added load. Substation No. 1A has three 1000-kva 11,000/2300-v single-phase outdoor transformers and necessary switchgear. The 2300-v power from 1A goes to substation No. 18 for distribution through metalclad vertical-lift switchgear to catalytic cracking unit, old and new alkylation plants and new boilers.

At No. 18, two 400-kva 3-phase indoor metalclad transformers step 11,000 v power down to 440 v, for distribution through a rebuilt open switch panel. In this same substation, three 100-kva 2300/240/120-v single-phase transformers and suitable switchgear supply lighting for new units. Power and light for new cooling tower, pumphouse and wells comes through substation No. 20, with two 300-kva 11,000/440-v 3-phase indoor metalclad transformers and switchgear arranged in two sets of cabinets. Provision is also made for 15 kva of 120/240-v lighting-transformer capacity. Substation No. 1A feeds No. 20 at 11,000 v.

Careful consideration went into protective arrangements. The 11,000-v breakers have 150,000-kva interrupting capacity, with dc solenoid and trip, while 2300-v breakers have 50,000-kva interrupting capacity. Pilot-wire relays protect all parallel feeders. Secondary 440-v equipment has 2200-kva breakers and air-break disconnects; current-overload relays with dc tripping protect circuit breakers. Storage batteries in No. 1A and 18 substations supply dc.



Boiler-plant control centers in this panel, complete with indicating and recording instruments, combustion-control equipment and controls for various auxiliaries



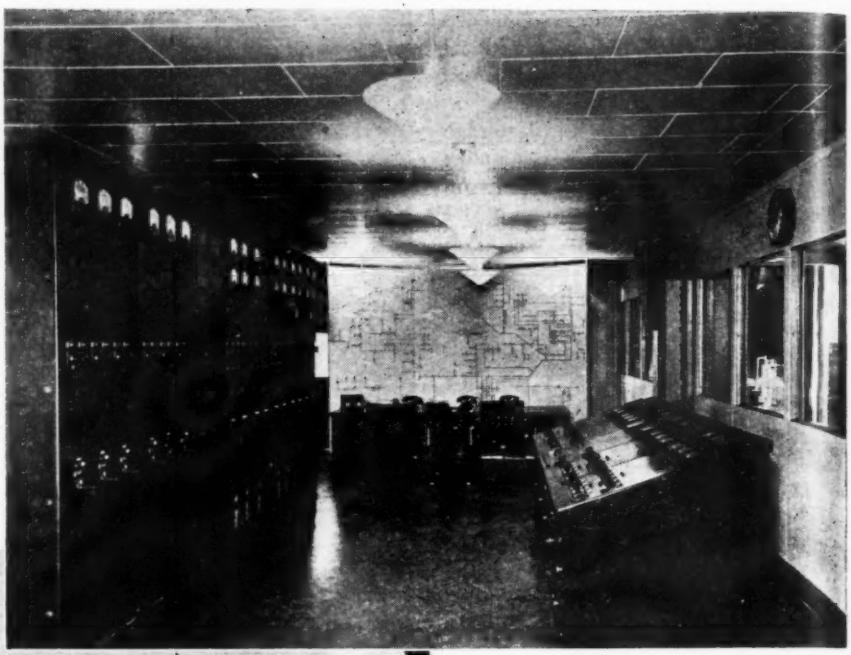
The four boiler-feed pumps are 6-stage units, each rated at 735 gpm against a head of 785 psi. Drive turbines take steam at 600 psi and exhaust to the 150-psi system

An underground system distributes power throughout the refinery, with tile duct laid in concrete for long runs and black-enameled conduit for short runs between manholes and switch houses. Conduit carries cable in operating areas. All cable is lead-covered, with sheath grounded at each manhole through a No. 0000 bar cable installed in concrete envelope below tile duct, brought out at each manhole and terminated at each substation in a copper ground plate set at permanent ground-water elevation. All pumps, motors, tanks, pressure vessels, heat exchangers and structures ground to a common system. Each substation has a water-pipe ground and all switchgear connects to this and to the common ground.

This article is based on information supplied by G C Leslie, utilities foreman, and W C Farquhar, electrical engineer, both of Richfield Oil Corp.

Put Right Light in Right Place for

Whether your problem is lighting a single-dial instrument or arranging an elaborate switchboard, the principles of glare elimination and easy seeing are the same. The "better-sight" engineers have put down the answers for adaptation to your plant's modernization program



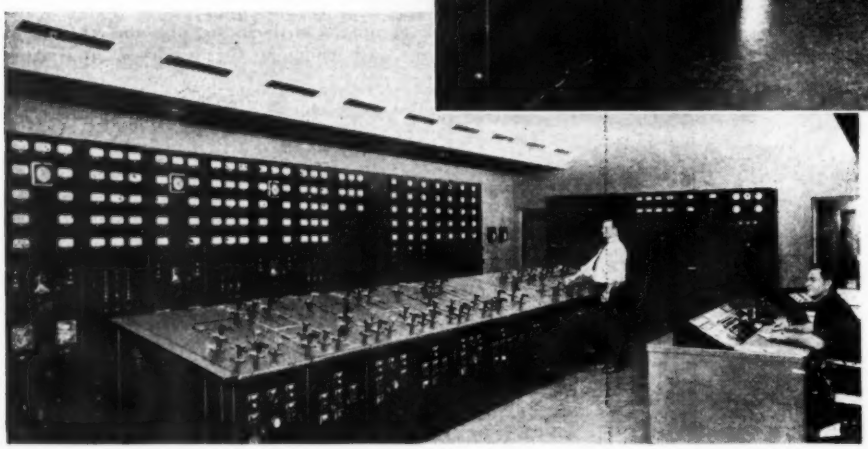


Fig. 1—A substation control room in the Southwest, with average illumination of 18-ft candles obtained with luminous indirect fixtures. The operators like it

Fig. 2—This TVA control room is exceptionally well illuminated, with indirect cove lighting aimed entirely toward arched ceiling from concealed units

► PROPER ILLUMINATION of switchboard and control-panel instruments has always presented a difficult lighting problem. However, more than lighting is involved as other factors must be considered in designing for maximum visibility, such as type and location of instruments, architecture of room, finish of panels and the like. To achieve best results, all must be coordinated into a single unified design.

Seeing tasks include observation of instruments, meters and gages along with occasional relay inspection. Control dials and board markings must be clearly visible. Instrument, meter and relay visibility are most important.

Switchboards and control panels vary considerably in size, shape and location of instruments. Meters requiring constant observation are, of course, located on the panel front, while other meters and relays may be either in front or in back of the panels.

The visibility problem can be resolved into six fundamental factors: (1) eliminating reflected glare from glass covers and bright fittings (2) eliminating direct glare in the field of vision (3) providing comfortable brightness contrasts throughout the room (4) providing enough light on instrument faces for accurate reading (5) locating instruments in the normal field of view to prevent strained positions for the observer (6) selecting a suitable type of instrument for local conditions.

Room Dimensions

Size and shape of the room are usually determined by the control equipment to be installed. However, for adequate lighting, the ceiling height should be not less than 11 ft nor more than 16. Also, the ceiling should be free of unnecessary obstructions.

Light-colored surfaces are best for seeing. The ceiling should be finished in eggshell white with a reflection factor of 80%, or more. Walls should preferably be light (cream, buff or green) with eggshell finish and a reflection factor of 50 to 60%. Floors should be light in color; white concrete is highly desirable.

Windows are often a source of annoying direct or reflected glare. A window back of a board but visible over the top causes direct glare. Light from windows back of the observer is reflected by glass instrument covers when viewed at an angle. Even glass brick can cause annoying glare. Most satisfactory conditions result if control rooms are windowless to eliminate the "daylight variable" with illumination by controlled artificial lighting throughout 24 hours of the day.

In existing structures, however, windows already present should be taken into account in locating the control panels to minimize glare effects. It

Control-Room Visibility

By WM H KAHLER, Lighting Engineer
PAUL MacGAHAN, Meter Division
C P WEST, Manager, Switchboard Engineering
Westinghouse Electric & Manufacturing Co

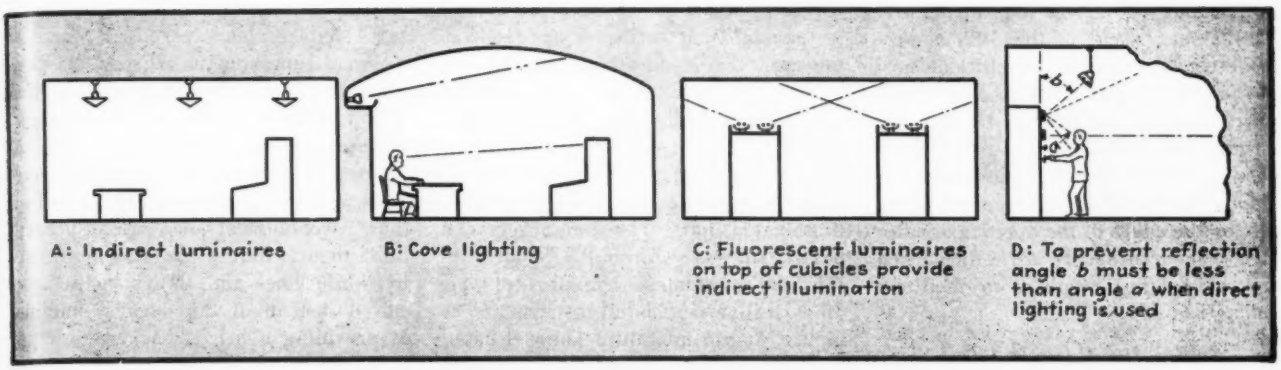

A: Indirect luminaires
B: Cove lighting
C: Fluorescent luminaires on top of cubicles provide indirect illumination
D: To prevent reflection angle b must be less than angle a when direct lighting is used

Fig. 3—Schematic summary of four important items: *A*, indirect luminaires prevent glare; *B*, cove lighting requires arched ceiling; *C*, fluorescent units on top of cubicles provide good indirect illumination; *D*, for direct lighting angle *b* must be less than angle *a* to avoid reflection, a common source of trouble in control-board illumination work

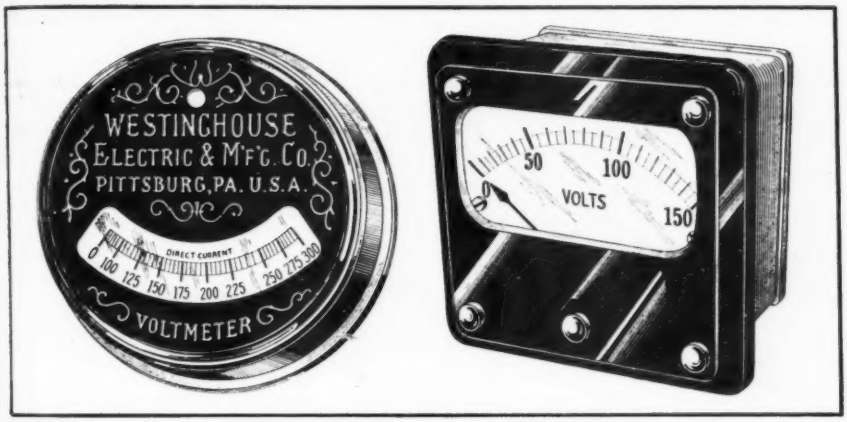


Fig. 4—Compare the visibility of the 50-yr old voltmeter (*left*) with a modern flush-mounted panel instrument's rectangular compact case with open face (*right*)

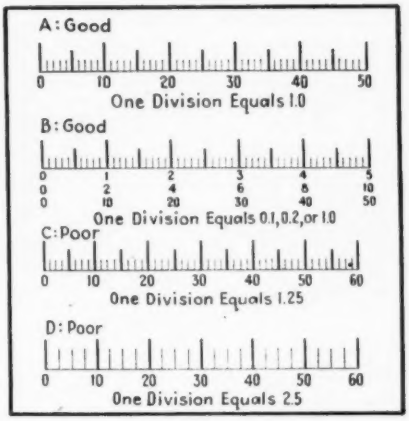

A: Good
0 10 20 30 40 50
One Division Equals 1.0
B: Good
0 1 2 3 4 5
0 2 4 6 8 10
0 10 20 30 40 50
One Division Equals 0.1, 0.2, or 1.0
C: Poor
0 10 20 30 40 50 60
One Division Equals 1.25
D: Poor
0 10 20 30 40 50 60
One Division Equals 2.5

Fig. 5—Instrument scale divisions in multiples of 1, 2 or 5 are easy to read

may be necessary to paint or otherwise cover some of the windows.

For artificial lighting in a control room, quality is equally as important as quantity. Indirect lighting has been found most suitable. If glare is eliminated, about 20 to 30 ft candles is sufficient for easy, quick seeing. Use either filament or fluorescent lamps in conventional indirect luminaires, in coves or on top of switchboards as shown in Fig. 1, 2 and 3. Contrary to accepted practice in many other applications, bare fluorescent lamps should never be used.

A conventional lighting system consists of indirect luminaires suspended from the ceiling, as illustrated in Fig. 1 and 3*A*. Either filament or fluorescent lamp equipment can be used, but the visible portion of the luminaires must have very low brightness or reflected glare occurs. This system can be used in new installations or in existing control rooms if a white ceiling at least 10 ft high is provided.

Indirect cove lighting results in more ideal conditions than suspended luminaires because a more uniform ceiling brightness can be attained. Bright spots or streaks cause reflected glare just as do high-brightness luminaires. Fig. 2 and 3*B* indicate how a cove at one side of the room provides maximum illumination on the instruments without discomfort to operators.

Cove Light Needs Arch

Cove lighting requires a shallow-arched white ceiling for uniform brightness. It is impractical for most flat ceilings because a high-brightness streak occurs close to the coves with relatively dark areas in the center.

Where instruments are located on parallel rows of switchgear cubicles, the method of Fig. 3*C* is suggested. Indirect lighting is provided by fluorescent luminaires on top of the cubicles. Low and uniform ceiling brightness with excellent quality illumination results, free of glare and harsh shadows. Illumination is adequate for reading instruments on either side of the cubicles. Of course it is essential to have a white ceiling and light-colored walls.

If indirect lighting is entirely impractical, acceptable illumination can be obtained with direct fluorescent equipment, properly installed. Fluorescent luminaires can be arranged to form a continuous line of light. Luminaires must be precisely located to minimize reflected glare and shadows on the instruments. Proper location depends on meter placement and normal position of the observer. Fig. 3*D* illustrates the main law: that the light source is reflected from a glass meter cover at an angle equal to the angle at which the light strikes the meter. Locate light sources so that the reflection will not

be directed toward the observer's eyes when he is in normal position to read.

Good readability is an important feature of instrument design. Easy reading scales, therefore, help increase visibility along with good lighting. Early instruments, such as the 19th-century model sketched in Fig. 4, left, had most of the scale concealed, with only a narrow sector and the pointer tip showing through the glass. Modern practice exposes as much of the scale plate and pointer as possible to avoid shadows cast by the edges of the opening. Scales of best modern meters are well marked and have large numbers to facilitate quick reading.

Scales for Easy Reading

In general, uniformly spaced scales are best but are possible only on dc meters and ac wattmeters. Some inequality and crowding at the lower scale points cannot be avoided in other types. However, meter designers aim at easy reading by using relatively heavy lines and division units of 1, 2, 5, or some multiple easily subdivided, as illustrated in Fig. 5. Scale divisions of 1½, 2½, 3 or 4 are considered poor.

Another consideration that affects good seeing is proper size of instrument scale for distance between scale and operator's eye for normal reading. Dial diameters around 2 to 3 in., "miniature" types, are suitable for small panels for radio, aviation or electronic applications where located close to the observer. Larger dials are preferred for power or control switchboards where the operator is usually stationed at some distance from the instruments. Scales usually range from 4 to 7 in. The modern tendency is to avoid very large sizes such as were more common in the early days of the industry.

For accuracy, there is no radical difference between large and small switchboard instruments except in the matter of readability from a distance. For example, a small instrument located close to the operator appears just as large and is as easily read as a larger one farther away. Modern 5- to 7-in. instruments not only allow compact instrument panels but provide accurate readability.

In selecting from available sizes and scales offered by manufacturers, the control-room designer should consider distance from which instruments are to be read and reading accuracy desired. For example, suppose the human eye can distinguish two lines when they are separated by enough space to result in an angle of one minute at the eye. If it is desired to read a scale to one-percent accuracy, a 5-in. scale could be located as far away as 14 ft. A black division line of the usual 0.02-in. width subtends an arc of one minute at a distance of 7 ft. Fig. 6 illustrates length of scales for about 1% accuracy of readability at various distances from the eye. These data check fairly well with tests made under good lighting conditions with observers having normal eyesight.

If surrounding conditions are dim or dark, it may be desirable to use an illuminated dial. The dial proper can be translucent, with bulbs located inside the instrument behind the face. Modern illuminated-dial instruments, as in Fig. 7, use miniature lamps located to light dial and pointer indirectly from the front, as do automobile-dash instruments commonly. Sometimes interior lighting of the instrument may improve readability to a considerable extent, especially when instrument glass reflections cannot be eliminated through proper location with respect to general lighting of the switchboard.

What Color for Dials?

With few exceptions white dials with black letters are accepted as standard in American industry where it is general practice to provide good illumination. Black dials with white numerals, however, are of advantage in special cases. Originally the idea of black dials with white markings was based on the "psychological" or "visual perception" theory, that is, showing positively by white lines the things to be perceived instead of the negative method of providing a bright background that is not the thing to be perceived directly. In practice, experience with these ideas indicates that black dials with white figures and pointers are effective in inclosures where general illumination must be low or where, as on automobile

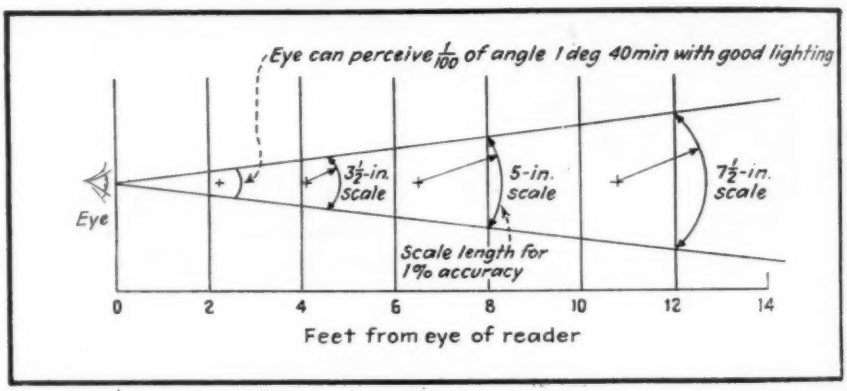


Fig. 6—Approximate relationship between viewing distance and scale length

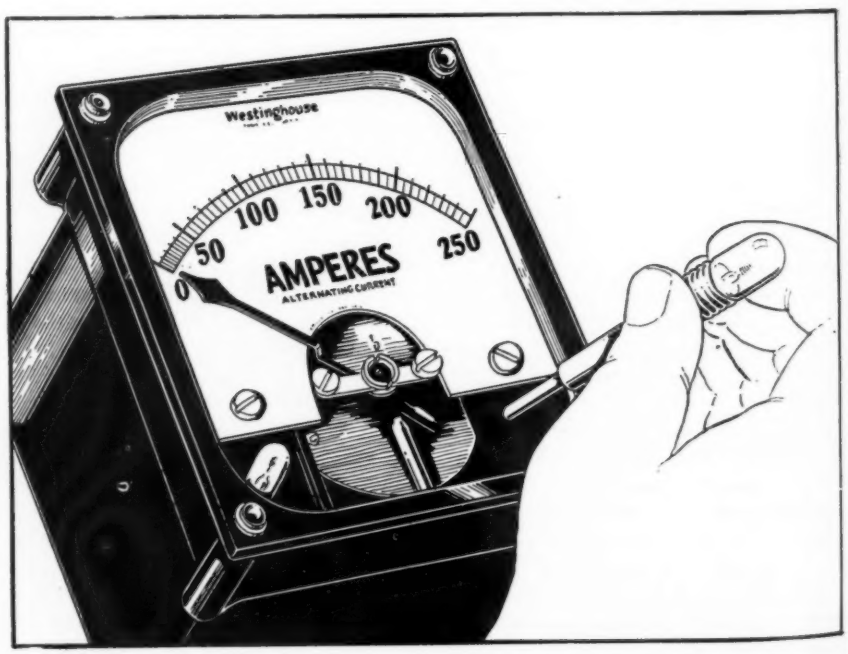


Fig. 7—Miniature lamps, concealed beneath the inclosing cover, light this meter

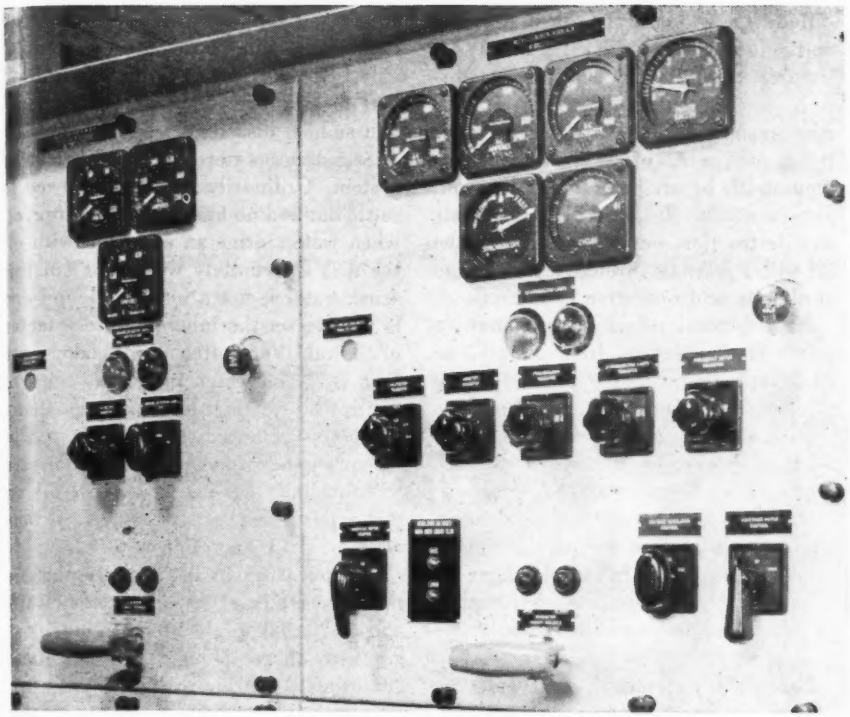


Fig. 8—Light gray panels create sharp contrast for controls and instruments, which may be white-on-black as shown, or have white dials with black letters

dashboards, light from white dials interferes with visibility of other poorly illuminated objects.

Black dials are often used for aircraft and ordnance instruments, especially for dials marked with fluorescent or radium paint. Such instruments must frequently be read under "black light" conditions.

In recent years many attempts have been made to eliminate glare reflected from glass by etching or otherwise treating the surface, to diffuse or alter the reflected rays. While some schemes have appeared to offer advantages under particular conditions, results on the whole have been disappointing. Desirability of some surface treatment remains, however, and it is hoped a solution may come in the near future. Generally speaking, the matter calls for preventive measures such as described here rather than "cures."

Another consideration for the designer is that of locating instruments directly in the operator's normal field of view, if possible. When standing, the normal person's eyes are 60-65 in. above the floor. Instruments are generally located within 24 in. above or below this level. All reflected glare from overhead lighting can be eliminated by locating instruments below eye level.

While black has been the conventional color for switchboard panels, recent studies have shown light-colored panels more desirable. The eye adjusts itself to average brightness. An eye adjusted to the dark average brightness of a black panel cannot see the instrument detail with maximum visibility when instrument scales have high brightness. Extensive tests have proved that maximum visibility is obtained when brightness of surroundings and brightness of task are about equal. Several installations of light-colored switchboards have proved acceptable. Not only is visibility improved but the light color brightens the appearance of the entire working environment.

Light-colored panels may be gray, buff or green with a non-glossy surface that is hard, durable and easy to clean. Reflection factor should be about 50%.

Where operators are at a central desk, instrument visibility is improved by arranging panels on the arc of a circle with the desk at approximate center. To meet all visibility requirements, it is essential to coordinate design of room, lighting, instruments and panels. Proper interrelation of these components results in real returns of improved visibility engineered for correct seeing.

Just 0.001 Inch from Destruction

Lubrication oils can "take it" because nature built into them a safety factor, but dire consequences follow abuse of an oil film, says W G Forbes*, Tidewater Associated Oil Co engineer

▶NATURE HAS, fortunately, endowed mineral oils with a considerable factor of safety which protects mechanical equipment against broken oil films even when operating conditions vary widely and machines are subjected to adverse temperature surroundings. Engines and other machinery are often lubricated with oils and greases not particularly suited to the service required and nothing very drastic seems to happen—except perhaps a little premature wear.

Operators should ask themselves why this is so. The answer, of course, is that lubricating oils tend to adjust themselves to surrounding conditions. If an oil happens to be a little too viscous for a particular operation, the excess amount of fluid friction that develops within the oil film automatically causes a rise in temperature, and, within reason, the oil automatically drops in viscosity. This natural governing system comes into play and a balance is established.

However, this balance will fail if the oil is much too viscous. Rapid wear or failure of the oil film results if the oil is too sluggish to follow the moving parts. On the other hand, if an oil is much too light for a particular operation, the oil film will be relatively thin and vulnerable to intermittent rupture. It will struggle hard to function

* Author of "Lubrication of Industrial and Marine Machinery" and "Lubricants and Cutting Oils for Machine Tools"

and, unless conditions are overwhelming, it will provide at least partial lubrication. This is what is meant by *factor of safety*.

Manufacturers of equipment, by means of plates, tags and printed instructions, indicate general specifications for oils and greases that give best results for particular engines or other machinery. Following these specifications is not only commendable but quite necessary in the majority of cases. For example, turbine designers generally recommend an oil having a Saybolt viscosity of 150 sec at 100 F for direct-connected units equipped with circulating-oil systems. Manufacturers of hypoid gears recommend an SAE 90 extreme-pressure oil, and so on. This practice should be more widely employed so that there is no necessity for much of the guesswork still left for the operator to figure out after purchasing mechanical equipment. Correct lubrication is far too important for any guesswork.

Were it not for the amazing ability of lubricating oils to adapt their peculiar properties to a range of operating conditions there would be little progress on the face of this earth. It is hardly believable that all the scientific factors were worked out before the first railroad train traveled 90 miles an hour riding on a series of oil films about one-thousandth of an inch thick. This oil film is all the distance between safety and destruction, yet oil remains on the car-wheel journals through a wide range of climate and operating conditions.

As a general rule lubricants have a safety factor ranging from about 2 to 10. Suppose one ignored a turbine-manufacturer's recommendation calling for 150-sec viscosity oil and substituted oil twice as heavy, or 300 sec at 100 F. Would the bearings go to pieces? Probably not. The over-all lubricating conditions might not be quite so favorable but no real harm would come to the turbine. It is quite probable that no difference in operation would be noticed.

This does not mean, however, that rules of lubrication can be blithely ignored. Just as engineers responsible for a bridge insist on no encroachment of the factor of safety, deliberately allowed for unknown and unevaluated conditions, the automatic factor of safety in lubricating oils has a limit and to step over the line invites swift and sudden disaster.

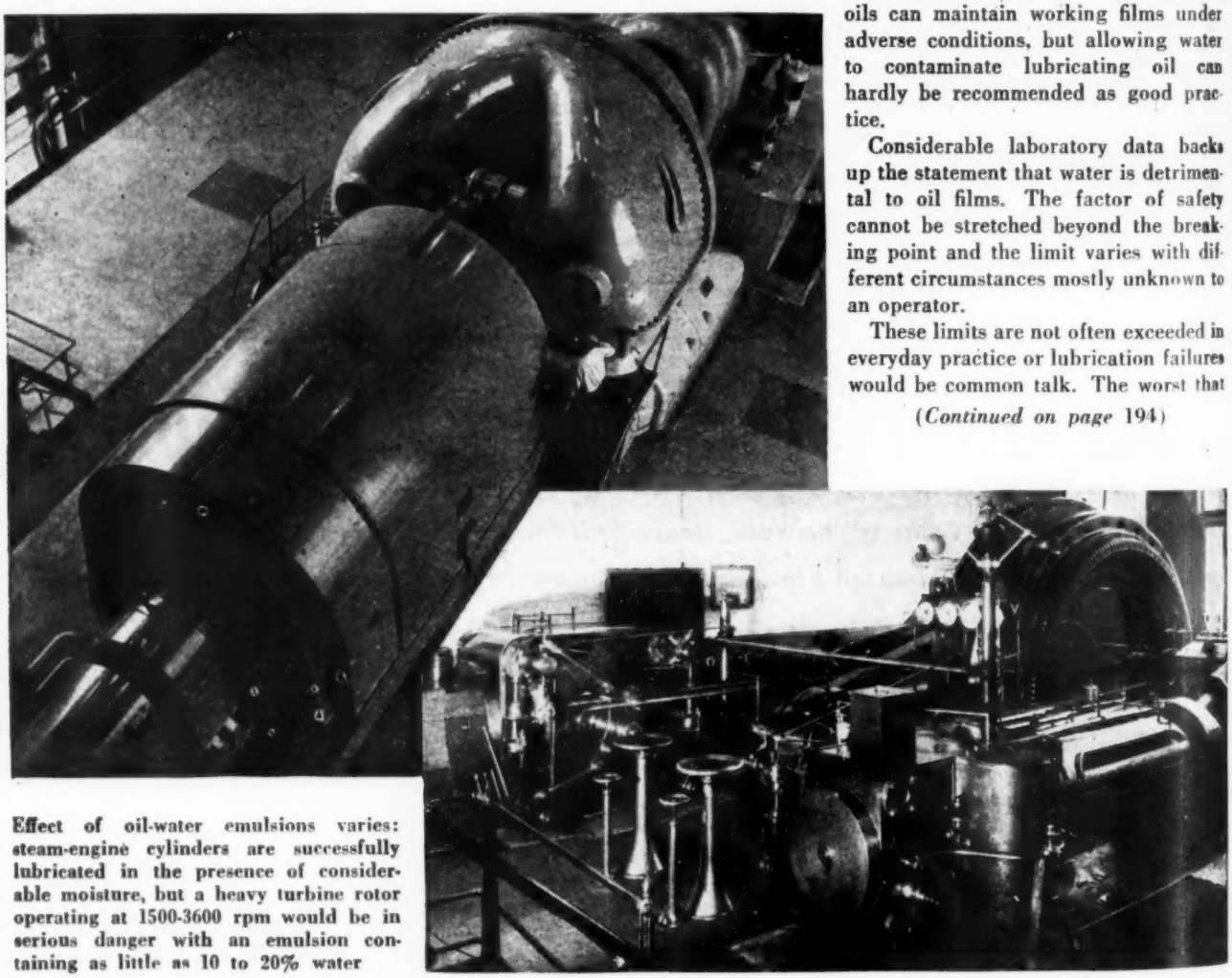
Sometimes water enters a lubricating system. Ordinarily it can be allowed to settle out and no harm results. However, when water forms an emulsion with oil the film is definitely weakened (in this sense water is not a lubricant) and one is trading on the inherent safety factor of the oil. Very often it will take more than 50% of water in the oil film to disrupt lubrication. For example, steam cylinders are successfully lubricated in the presence of considerable moisture with original tool marks still visible on the cylinder walls after three or four years of daily operation.

On the other hand, a heavy turbine rotor operating at speeds between 1500 and 3600 rpm would be in serious danger with an emulsion containing 10 to 20% water. Marine turbines have often been reported to have water content even higher than these figures but bearings were not wiped because the viscous oils customary in marine practice could "take it." It is amazing that oils can maintain working films under adverse conditions, but allowing water to contaminate lubricating oil can hardly be recommended as good practice.

Considerable laboratory data backs up the statement that water is detrimental to oil films. The factor of safety cannot be stretched beyond the breaking point and the limit varies with different circumstances mostly unknown to an operator.

These limits are not often exceeded in everyday practice or lubrication failures would be common talk. The worst that

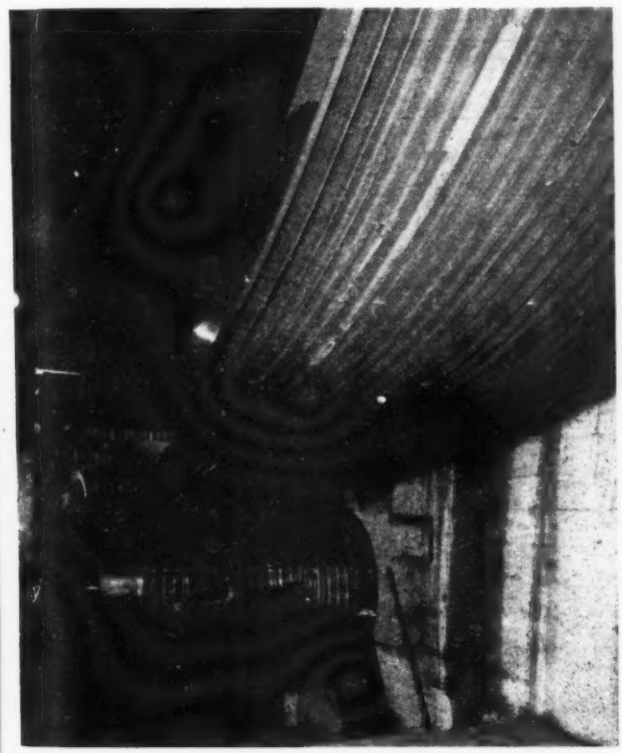
(*Continued on page* 194)



Effect of oil-water emulsions varies: steam-engine cylinders are successfully lubricated in the presence of considerable moisture, but a heavy turbine rotor operating at 1500-3600 rpm would be in serious danger with an emulsion containing as little as 10 to 20% water

V-Belts Connect 1500-Hp Engine to Load

In what is probably the largest multiple V-belt installation in the world a large flour mill uses 81 belts, totaling nearly one mile in length. In six drives they connect a 1500-hp corliss engine to a countershaft and to the mill lineshafting



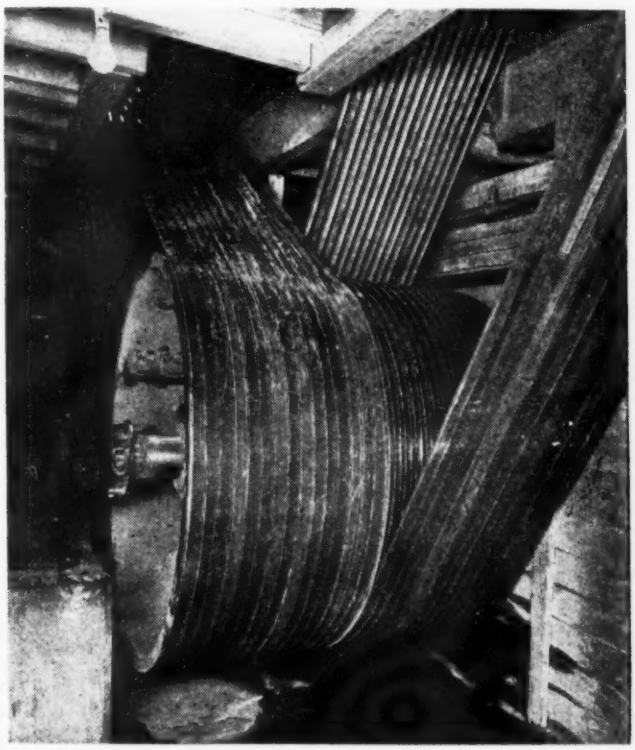


Fig. 1 (*left*) Main drive from 1500-hp engine 18-ft flywheel sheave to 7-ft sheave on countershaft on 18-ft center distance. There are 21 G-section belts (2.5-in. top width 1.25-in. depth) each 76 ft in length. A 5-ft flat idler pulley maintains correct tension in belts. Fig. 2 (*right*)—This countershaft (in the mill basement) driven by the 1500-hp engine, connects to the mill shafting by two multiple V-belts, each having fifteen E-section belts operating on 60-in. sheaves and 28-ft center distance. Each belt is 66 ft, 8 in. long; a 36-in. flat idler on outside of slack strand maintains correct belt tension

▶ WHEN THE Russell-Miller Milling Co, Minneapolis, Minn., acquired the plant of the Standard-Tilton Milling Co, Alton, Ill., they decided to modernize the main power drive. In their Minneapolis A mill was a 1500-hp engine, in good condition, which a modernization program had replaced with an electric motor. The setup at Alton was favorable for the engine's economical use to drive the plant after it had been modernized, and accordingly installation plans were made to connect it to the main lineshaft.

In Minneapolis the engine connected to the mill lineshaft through a rope drive. But in Alton the engine had to be installed where the center distance between its 18-ft flywheel sheave and 7-ft sheave on a countershaft in the plant's basement was only 18 ft, or 5.5 ft between sheaves. This prevented using the rope drive as previously, so a multiple V-belt was considered. As a result, what is probably the highest powered V-belt application in the world was designed, built and installed by the B F Goodrich Co.

This drive consists of 21 G-section belts (top width 2.5 in., depth 1.25 in.) each 76 ft in length. The 21 belts weigh about one ton. The engine rope-sheave flywheel was regrooved for the G-section belts. To maintain correct tension in the belts a 5-ft flat idler was installed on their bottom strands, Fig. 1, which are the slack ones. Mounted in movable bearings, the idler can be pressed readily against the belt strands to maintain the best working tension in them at all times and keep belt slip at a minimum.

From the countershaft two multiple V-belt drives each connect to a mill shaft on the second floor. In each of these drives 15 E-section belts connect a 60-in. sheave on the countershaft to a 60-in. sheave on the mill shaft. Each of these belts is 67 ft long, operating on 28-ft centers with a 36 in. idler to maintain correct belt tension. There are also three multiple V-belt drives between mill shaft and line shafts. Each of these consists of ten E-section belts, 35 ft long.

This installation represents what is probably the largest V-belt drive in the world. If laid end to end the belts would be nearly one mile long. They transmit power to produce 3500 bbl of flour per day.

Check Refrigerating Equipment With This Tested Guide

H A Boysen converts the usual per-minute per-pound figures for ammonia into values per ton of refrigeration. Let's take a look at his practical method of checking plant performance

► WHEN LIQUID REFRIGERANT expands in a refrigerating-system evaporator, a certain minimum amount of energy must be expended to bring the gas back into the receiver as a liquid. Local conditions, equipment performance and process procedures largely determine plant efficiency, but a certain minimum energy exchange—a bare transfer of Btu for Btu—must be made. Numerical value of this amount gives a key to minimum capacity required and eventually to equipment performance.

When studying the Mollier chart we find values quoted as: per min, per lb of ammonia, but not per ton of refrigeration, a value of greater interest and more practical help to an operating engineer. Most equipment is rated in tons and an engineer speaks and thinks in this term; he wants to know (1) condenser load in Btu per min per ton, (2) water requirements in gal per min per ton per deg of temperature difference and (3) compressor work in hp and Btu per min per ton instead of per lb of ammonia.

To find these values I made a curve and tabulated figures that have nearly exact and direct reference to the Mollier chart for various pressure combinations, without considering aftercooling or superheat other than through compression. Volumetric efficiencies are for single-acting compressors with poppet valves working on dry suction and compressed gas.

For instance, Table I shows that a minimum of 1.73 hp per min per ton is required to compress ammonia gas from 15-psi-abs suction pressure to 190-psi-abs. At these pressures the condenser must absorb a minimum of 272.9 Btu per min per ton and it takes a minimum of 32.9 gal of water per min per ton per deg temperature difference to liquefy the gas.

Using Tables I and II it is possible to check equipment capacity and performance. Then determine minimum amount of work done in each section of the refrigeration cycle to satisfy refrigerant

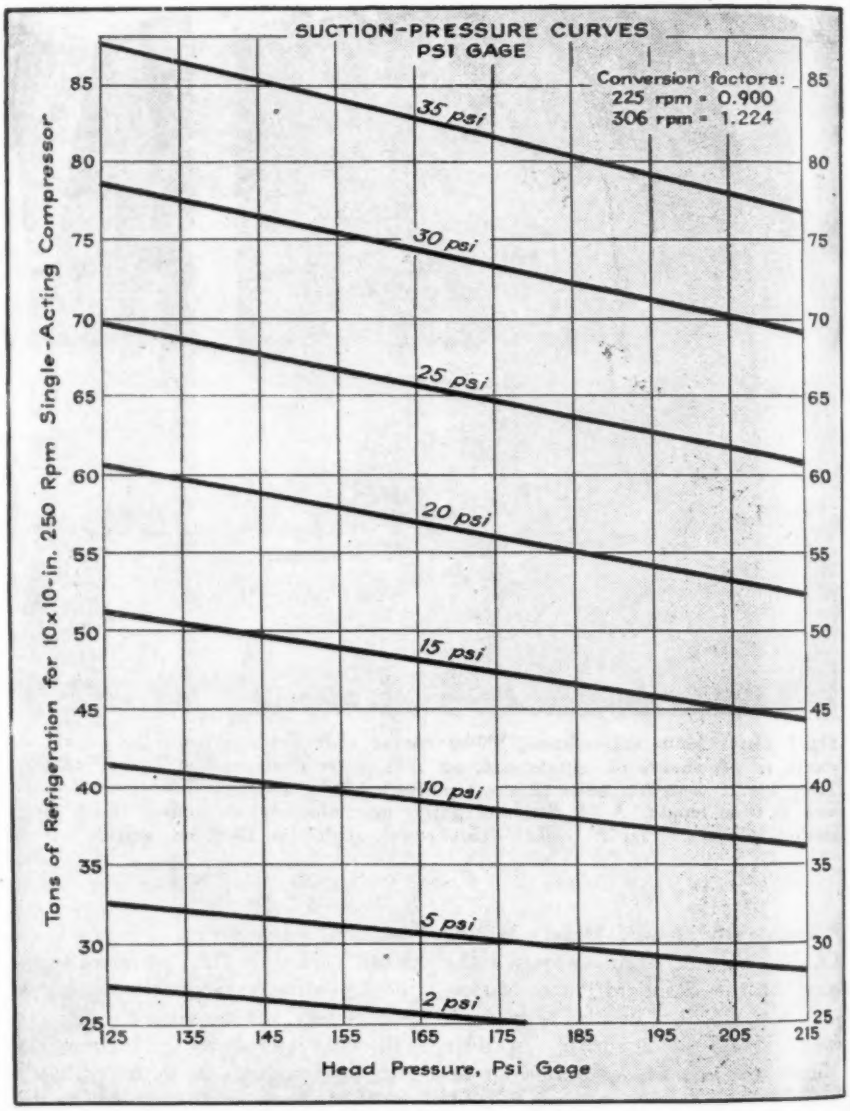


Fig. 1—Ten-ton change in compressor capacity for each 5-psi variation in suction pressure is not unusual. Calculations are based on absolute pressure

thermodynamic laws represented in the Mollier chart. Consider an evaporator whose surface has been determined by

$$\frac{\text{tons} \times 12{,}000}{\text{HT} \times \text{MTD}} = \text{sq ft area}$$

Factor HT (heat transfer) and MTD (mean temperature difference) have pronounced elastic features. Heat transfer is quite variable. It usually makes little difference whether evaporator pipes and tubes are iron, steel, copper, monel or stainless steel because actual capacity increase when copper is used instead of iron is negligible.

A 0.01-in. thick stagnant-liquid film on the metal surface reduces heat transfer through a copper-plate from 40,000 to 300 Btu per sq ft. While film thick-

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TABLE I—USEFUL UNIT REFRIGERATION FACTORS

Columns 1, 2		Column 3	Column 4	Column 5	Columns 6, 7, 8			Columns 9, 10		Columns 11, 12		Column 13	Column 14
Discharge pressure		Vapor volume after expansion, cu in./ min/ton	Volumetric efficiency, %	Needed piston displacement, cu in./ min/ton	Capacity of 10 x 10 compressor, tons, at			Compressor work		Condenser work		Water required, gal/min/ ton/F temp. difference	Wt of liquid HN_3 expanded, lb/min/ton
Gage	Abs				225 rpm	306 rpm	250 rpm	Hp/ min/ton	Btu/ min/ton	Btu/lb HN_3	Btu/ min/ton		
Suction pressure: 15 psi abs, 0 gage. Volume: 30,534 cu in. Heat of vapor: 602.4 Btu; of liquid: 13.6 Btu.													
125	140	12,824	78.0	16,441	21.5	29.2	23.9	1.41	60.0	619	260.0	31.33	0.420
135	150	12,916	77.3	16,709	21.1	28.8	23.5	1.48	62.5	619	261.0	31.45	0.423
145	160	13,069	76.3	17,128	20.6	28.1	22.9	1.54	65.3	620	265.4	31.97	0.428
155	170	13,191	75.8	17,402	20.3	27.6	22.6	1.60	68.1	621	268.7	32.36	0.432
165	180	13,313	75.3	17,680	20.0	27.2	22.2	1.68	71.1	622	271.3	32.68	0.436
175	190	13,404	74.6	17,968	19.7	26.8	21.9	1.73	73.1	622	272.9	32.88	0.439
185	200	13,527	74.0	18,280	19.3	26.3	21.5	1.81	76.9	624	276.9	33.36	0.443
195	210	13,649	73.6	18,545	19.1	25.9	21.2	1.86	78.9	624	279.1	33.62	0.447
Suction pressure: 20 psi abs, 5-psi gage. Volume 23,328 cu in. Heat of vapor: 606.2 Btu; of liquid: 25 Btu.													
125	140	9,739	81.4	11,957	29.6	40.2	32.8	1.21	51.5	603	252.0	30.36	0.417
135	150	9,798	80.5	12,171	29.0	39.5	32.3	1.27	53.7	603	254.0	30.68	0.420
145	160	9,891	79.7	12,410	28.5	38.7	31.6	1.33	56.5	604	256.3	30.88	0.424
155	170	9,938	79.0	12,580	28.1	38.2	31.2	1.40	58.4	605	259.2	31.23	0.428
165	180	10,078	78.4	12,855	27.5	37.4	30.5	1.46	61.7	606	261.7	31.53	0.432
175	190	10,171	77.8	13,073	27.0	36.8	30.0	1.51	64.0	606	264.1	31.82	0.436
185	200	10,241	77.1	13,283	26.6	36.2	29.6	1.56	66.6	607	266.5	32.11	0.439
195	210	10,330	76.5	13,503	26.2	35.6	29.1	1.63	69.0	607	269.0	32.41	0.443
Suction pressure: 25 psi abs, 10-psi gage. Volume 18,939 cu in. Heat of vapor: 609.1 Btu; of liquid: 34.3 Btu.													
125	140	7860	83.6	9,402	39.6	51.1	41.8	1.05	44.5	590	245.0	29.52	0.415
135	150	7954	83.0	9,583	37.6	50.2	41.0	1.12	47.0	590	248.0	29.88	0.420
145	160	7992	82.5	9,687	36.5	49.6	40.5	1.16	49.3	591	249.4	30.05	0.422
155	170	8068	81.8	9,863	35.8	48.7	39.8	1.22	51.9	592	252.1	30.37	0.426
165	180	8125	81.1	10,018	35.3	48.0	39.2	1.28	54.4	592	253.3	30.52	0.429
175	190	8201	80.5	10,188	34.7	47.2	38.5	1.35	57.3	593	257.3	31.00	0.433
185	200	8257	79.8	10,347	34.2	46.5	38.0	1.38	58.4	593	258.1	31.09	0.436
195	210	8333	79.0	10,548	33.5	45.6	37.2	1.44	60.9	593	260.9	31.43	0.440
Suction pressure: 30 psi abs, 15-psi gage. Volume: 15,967 cu in. Heat of vapor: 611.6 Btu; of liquid: 42.3 Btu.													
125	140	6578	86.5	7605	46.5	63.2	51.6	0.93	39.6	581	240.0	28.91	0.412
135	150	6642	85.5	7768	45.5	61.9	50.6	0.97	40.8	581	241.0	29.03	0.416
145	160	6706	84.5	7936	44.5	60.6	49.5	1.03	43.8	581	244.0	29.40	0.420
155	170	6754	83.9	8050	43.9	59.7	48.8	1.08	45.8	581	246.1	29.64	0.423
165	180	6818	83.1	8200	43.1	58.6	47.9	1.13	48.0	581	248.0	29.88	0.427
175	190	6882	82.6	8332	42.4	57.7	47.1	1.19	50.6	582	250.8	30.22	0.431
185	200	6930	81.6	8472	41.7	56.7	46.4	1.24	52.5	582	252.4	30.41	0.434
195	210	6994	81.2	8613	41.0	55.8	45.6	1.29	54.7	582	254.9	30.71	0.438
Suction pressure: 35 psi abs, 20-psi gage. Volume: 13,807 cu in. Heat of vapor: 613.6 Btu; of liquid: 49.3 Btu.													
125	140	5661	87.9	6440	54.9	74.6	61.0	0.81	33.4	572	234.0	28.19	0.410
135	150	5730	87.0	6586	53.7	73.0	59.6	0.88	37.0	572	238.0	28.67	0.415
145	160	5771	86.4	6679	52.9	72.0	58.8	0.92	39.2	572	239.3	28.93	0.418
155	170	5827	85.8	6791	52.0	71.0	57.8	0.99	41.9	573	242.1	29.17	0.422
165	180	5868	84.7	6928	51.0	69.4	56.7	1.03	43.5	573	243.4	29.32	0.425
175	190	5923	84.1	7043	50.2	68.2	55.8	1.08	45.6	573	245.7	29.60	0.429
185	200	5965	83.4	7152	49.4	67.2	54.9	1.12	47.7	573	247.6	29.83	0.432
195	210	6020	82.8	7271	48.6	66.1	54.0	1.17	49.7	573	249.8	30.09	0.436
Suction pressure: 40 psi abs, 25-psi gage. Volume: 12,177 cu in. Heat of vapor: 615.4 Btu; of liquid: 55.6 Btu.													
125	140	4993	88.9	5616	62.9	85.6	69.9	0.73	31.0	565	232.0	27.95	0.410
135	150	5041	88.2	5715	61.8	84.1	68.7	0.77	32.9	565	233.0	28.07	0.414
145	160	5066	87.6	5783	61.1	82.1	67.9	0.83	35.2	565	235.0	28.31	0.416
155	170	5114	86.9	5885	60.1	81.7	66.7	0.89	37.4	565	237.4	28.60	0.420
165	180	5163	86.3	5983	59.1	80.3	65.6	0.94	39.7	565	239.9	28.90	0.424
175	190	5200	85.7	6068	58.2	79.2	64.7	0.98	41.5	565	241.4	29.08	0.427
185	200	5236	85.0	6160	57.4	78.0	63.8	1.02	43.3	565	243.0	29.28	0.430
195	210	5285	84.4	6262	56.4	76.8	62.7	1.08	45.8	565	245.8	29.61	0.434
Suction pressure: 45 psi abs, 30-psi gage. Volume: 10,898 cu in. Heat of vapor: 616.9 Btu; of liquid: 61.3 Btu.													
125	140	4457	89.4	4985	70.9	96.4	78.8	0.67	28.3	559	229.0	27.59	0.409
135	150	4490	89.0	5045	70.1	95.3	77.8	0.71	30.1	559	230.0	27.71	0.412
145	160	4523	88.6	5105	69.2	94.2	76.9	0.75	32.0	559	232.0	27.95	0.415
155	170	4566	88.0	5189	68.1	92.6	75.7	0.80	34.0	559	234.1	28.20	0.419
165	180	4599	87.4	5262	67.2	91.3	74.6	0.85	35.9	559	235.8	28.41	0.422
175	190	4643	86.7	5355	66.0	89.8	73.3	0.90	38.0	559	238.0	28.67	0.426
185	200	4675	86.0	5436	65.0	88.4	72.2	0.94	39.9	559	239.9	28.90	0.429
195	210	4719	85.4	5526	64.0	87.0	71.1	0.99	42.0	559	242.2	29.18	0.433
Suction pressure: 50 psi abs, 35-psi gage. Volume 9867 cu in. Heat of vapor: 618.2 Btu; of liquid: 66.5 Btu.													
125	140	4016	89.8	4472	79.0	107.5	87.8	0.59	24.7	553	225.0	27.11	0.407
135	150	4045	89.3	4530	78.0	106.1	86.7	0.64	27.0	553	227.0	27.35	0.410
145	160	4075	88.9	4584	77.1	104.9	85.7	0.68	28.8	553	228.4	27.52	0.413
155	170	4124	88.3	4670	75.7	102.9	84.1	0.73	30.9	553	231.0	27.83	0.418
165	180	4154	87.7	4737	74.6	101.5	82.9	0.77	32.8	553	232.7	28.03	0.421
175	190	4193	87.1	4814	73.4	100.0	81.6	0.82	34.6	553	234.7	28.28	0.425
185	200	4223	86.4	4888	72.3	98.3	80.3	0.86	36.6	553	236.7	28.52	0.428
195	210	4253	85.7	4963	71.2	96.8	79.1	0.92	38.9	553	238.7	28.76	0.431

Calculations based on absolute pressures

ness increases with fluid viscosity, it decreases with increased velocity flow. However, beyond a certain maximum velocity there is no proportional improvement in heat transfer.

Initially, therefore, flow velocity is an important factor in brine-cooler or ice-tank evaporator design. An inadequate agitator or circulating pump may cause considerable lagging refrigerating effect. Of course, additional loss results if foreign matter from cooling or cooled medium deposits on heat-transfer surfaces. This easily cuts output in half, especially on equipment with concealed or hard-to-get-at surfaces like flake-ice machines and some sanitary coolers. Therefore, refrigeration effect in the cooler can get a considerable jolt from an impaired HT factor alone.

The chosen MTD, a direct measure of the rate at which heat is transferred, between inlet and outlet temperatures of the cooling and cooled medium, also influences plant operation.

If the design is based on too-high a MTD or too-high a rate of heat transfer, resulting equipment is low in first cost but proves expensive and gives unsatisfactory service. Accepting a broad range of temperatures for the sake of a low bid leads to still greater temperature differences in operation. Initial sacrifice of heat-transfer surface for MTD, frequently makes it necessary to operate at unproportionately lower and less economical suction pressures. Extra compressors must be run, and inlet-floats and backpressure valves bypassed. At best the operating cycle is decidedly unstable and bound to become worse as heat-transfer deficiency increases. If equipment design is originally at fault nothing can be done except provide additional surface.

Establish Initial Values

Once initial facilities and capacities are established it is not difficult to keep a close check on the efficiency of individual units. For example: When 500 gal of calcium brine circulates through a cooler and piping system interconnected with process cooling (secondary), temperature difference determines the approximate heat load carried. Heat capacity of brine varies with its density and temperature. Here it may be taken as 1/27 ton per deg per gal per min. Assume a temperature difference of 6F between inlet and outlet brine, then $\frac{6 \times 500}{27} = 110$ tons of refrigeration or 18.5 tons per deg difference.

Pump capacity in gpm conforms to manufacturers' rating if the relief valve is set so that rated head is maintained.

CHECK LIST FOR REFRIGERATION CYCLE

1. Weight of HN_3 expanded
2. Cooling water required
3. Work done by compressor
4. Needed piston displacement
5. Volume of expanded HN_3
6. Head pressure
7. Suction pressure
8. Evaporator surface
9. Condenser cleanliness
10. Compressor volumetric eff
11. Liquid-flow velocity

For other heads the gpm may be obtained thus:

$$\frac{\text{watts} \times 0.85 \times 33000 \times 0.70 \text{ eff}}{8.3 \times \text{total head in feet} \times 746}$$

Total head on the pump affects its efficiency (taken here at 70%), motor efficiency 85%. If there is considerable difference between actual and rated head, take efficiency factor from manufacturer's pump-performance curve.

While factors in Table I and II are combined as closely and accurately as possible to check equipment capacity, only a change of conditions, or a variation in the usual load characteristics are of major importance when checking operating performance. Assume 300 cans of milk per hr to be cooled within fixed temperature limits after pasteurization. The job may be done with a large quantity of comparatively high-temperature brine, or less brine at lower temperature.

Loss in Efficiency

Perhaps after several weeks at the same load more and more brine must be admitted to the process circuit because brine deposits accumulate on the sanitary cooler plates or the cooler's efficiency becomes impaired from other causes. While load on the brine cooler is still at a par with the imposed load (milk) at the pasteurizing end, the deficiency is nevertheless apparent in a lowered brine-pressure reading. The increased amount of brine flowing only continues to do the work as long as there is sufficient plate capacity in the cooler. Eventually when valves are wide open and maximum amount of brine circulates in the process circuit, further cooling does not occur and brine circulates with gradually decreasing range between inlet and outlet temperatures. This change in range need not be great to have decided effect on product cooling. The 300 cans of milk to be cooled per hr is equivalent to about 50 gpm. With a 50-F difference between the product inlet and outlet temperatures:

$$\frac{50 \text{ gpm} \times \text{sp ht} \times \text{sp wt} \times 8.3 \times (90 - 40)}{200 \text{ Btu per min}}$$

or, roughly, $\frac{50 \times 8.3 \times 50}{200} = 104$ tons of refrigeration. With 500 gal of brine at 27 gal per deg per ton: $\frac{104 \times 27}{500} = 5.6$ F, the brine-temperature difference that would be expected.

If the difference were only 4 F, then only $\frac{4 \times 500}{27} = 74$ tons of refrigeration would be active against a 104-ton load.

Although 30 tons difference in work occurs with only 1.6-F difference in brine temperature, this small temperature difference shows up as

$$\frac{30 \times 200}{50 \text{ gal} \times 8.3} = 14.5 \text{ F}$$

higher temperature in the milk.

Ammonia Expanded

Weight of ammonia liquid that must be expanded to produce one ton of refrigeration in the evaporator for the various pressure combinations is given in last column of Table 1. Column 3 gives the cu in. gas volume of the liquid after expansion. This is, of course, the theoretical volume handled by the compressors. However, volumetric efficiency must be considered so these factors (column 4) and the resulting actual minimum displacement (column 5) per ton of refrigeration for a 10x10-in. single-acting poppet-valve compressor are listed. Resulting capacities of the 10x10-in. compressor at three speeds are tabulated in columns 6, 7 and 8. Actual work in the compressor in Btu and hp per min per ton derived from the Mollier chart for the selected pressure combinations is found in columns 9 and 10.

Refrigerating capacity of a compressor varies directly as the absolute suction pressure and speed. Suppose the capacity at 20-psi suction pressure and 360 rpm is 12 tons, at 35 psi and 300 rpm the capacity would be:

$$\frac{12 \times (35 + 15) \times 300}{(20 + 15) \times 360} = 14.3 \text{ tons}$$

Change in compressor capacity for every 5-psi change in suction pressure is considerable. A 10-ton increase or decrease for such a pressure change is not unusual. Fig. 1. Intermediate values can be interpolated for each psi change in suction pressure. Capacity for other compressor sizes and speeds must be determined by conversion constants.

Combined heats, that of compression plus heat removed from the evaporator, enter the condenser. Average designers usually provide from 7½ to 10 or more sq ft of surface per ton of refrigeration.

but local conditions some times inject troublesome situations that the operator must contend with and try to rectify. Two- or 3-pass condensers have been changed to 7- and 10-pass units, expensive piping has been installed and changes made from series to parallel or series-parallel operation, not always as well-planned remodeling, but in a desperate effort to get relief from trouble.

Heat-transfer-surface area of condensers working satisfactorily is always in excess of the theoretical calculated value and is determined empirically rather than from slide-rule figures alone. Air and non-condensable gas, decomposed oil and oil itself, as surface film in condensers, have marked effect on heat-transfer coefficient and rate.

The minimum amount of heat entering the condenser per ton of refrigeration is directly proportional to work done in the compressor. For instance, 40-psi abs suction and 180-psi abs discharge pressure equals 239.9 Btu per min per ton, representing 39.8 Btu work of compression and 200 Btu refrigerating effect in the evaporator. Or, for 50 and 130 psi abs respectively, total is 223 Btu, 23 Btu in the compressor and 200 Btu in the evaporator.

Formula for heat transfer surface is:

$$\frac{\text{tons} \times 12{,}000}{\text{HT} \times \text{MTD}}$$

Modified for condensers:

$$\frac{\text{Tons} \times \text{work in condenser in Btu/min/ton} \times 12{,}000}{200 \times \text{HT} \times \text{MTD}} = \text{sq ft area}$$

Condenser heat transfer coefficient is greatly influenced by water velocity, which ranges in practice from 100 to 400 fpm for 100 to 225 Btu per sq ft per hr. A conservative figure is 100 Btu per sq ft per hr for a horizontal shell and tube condenser. Water velocity in pipes may be determined by:

$$\frac{\text{gpm}}{450} = \text{cu ft per sec and,}$$

$$\frac{\text{cu ft/sec}}{\text{area in sq ft}} = \text{velocity in ft per sec}$$

Mean temperature difference, or the rate at which heat is transferred, while easy to figure, is nevertheless difficult to establish as a condenser design value.

A glance at Table II "Temperatures of Ammonia Discharge Gas" reveals that the lowest temperature encountered in the selected pressure range is 140 F at 50 psi suction and 130 psi discharge pressure abs.

As temperature difference between ammonia gas and cooling water becomes smaller, rate of heat transfer becomes slower, which necessitates larger condensing surface. Assuming ammonia pressures of 50 and 130 psi abs, and water temperature 61F, find the minimum theoretical amount of surface needed in a condenser.

Ammonia will be cooled from 140 to 71 F (corresponding to 130 psi abs head-pressure). In a clean condenser the water should come off at about the same temperature.

Difference of higher temperatures:
$$140 - 71 = 69 \text{ F} = d_1$$
Difference of lower temperatures:
$$71 - 61 = 10 \text{ F} = d_2$$
Difference: $d_1 - d_2 = 69 - 10 = 59$

$$D = \log \text{MTD} = \frac{d_1 - d_2}{2.3 \log \frac{d_1}{d_2}}$$

$$= \frac{59}{2.3 \log 6.9} = 31.3 \text{ F}$$

Minimum surface for a 500-ton load at the selected pressure combination would be:

$$\frac{500 \times 223 \times 12{,}000}{200 \times 100 \times 31.3} = 2140 \text{ sq ft area}$$

Obviously the same result will be obtained by converting work in the condenser, Table I, Column 12, from a minute to an hourly rate directly by multiplying by 60 and the 500-ton load. This product is then divided by the HT and MTD values:

$$\frac{500 \times 223 \times 60}{100 \times 31.3} = 2140 \text{ sq ft}$$

This is the minimum surface required for a clean condenser and allowance must be made for water cleanliness and quality of operation. Usually the figures are increased slightly (about 30%) but circumstances may make it necessary to consider a 100% increase. Condenser water requirement according to Table I is nearly 27 gal per min per ton per deg. Therefore with 10 F temperature difference, the 500-ton load would require:

$$\frac{500 \times 27 \text{ gal/deg}}{10\text{F}} = 1350 \text{ gpm}$$

and the water would have to flow at 100 fpm over the heat transfer surfaces.

TABLE II—TEMPERATURE OF AMMONIA DISCHARGE GAS

Suction Pressure		*Discharge Pressure*											
Gage:		115	120	125	130	135	145	155	165	175	185	195	205
Gage	*Abs* *Abs:*	130	135	140	145	150	160	170	180	190	200	210	220
0	15	250	255	260	266	272	282	292	301	311	319	327	335
1	16	243	249	255	260	266	276	285	295	303	311	320	328
2	17	237	243	249	255	260	270	279	289	297	306	313	321
3	18	231	238	244	249	254	264	273	283	291	300	307	314
4	19	225	232	237	243	248	258	268	277	285	294	301	307
5	20	220	227	233	238	243	253	263	272	280	289	296	303
6	21	217	223	228	233	238	248	258	267	275	284	292	299
7	22	213	218	223	229	233	243	253	262	270	279	287	294
8	23	209	214	219	224	229	239	249	258	266	274	282	290
9	24	205	210	215	220	225	235	244	254	262	270	278	285
10	25	200	206	211	216	221	231	240	250	258	266	274	281
11	26	197	202	207	212	217	227	237	246	254	262	270	277
12	27	194	199	204	209	213	223	233	242	250	258	266	273
13	28	190	195	200	205	210	220	230	238	246	254	262	270
14	29	187	192	197	202	208	216	226	235	243	251	259	266
15	30	183	189	194	199	206	213	223	228	240	247	255	263
16	31	180	186	191	196	202	210	220	226	235	244	252	260
17	32	177	183	188	193	198	207	217	224	233	241	249	256
18	33	174	180	185	190	195	204	214	222	231	239	246	253
19	34	172	177	182	187	192	200	211	220	228	236	243	250
20	35	170	175	180	185	190	198	208	217	226	233	240	247
21	36	167	172	177	182	187	196	206	215	223	230	237	245
22	37	165	170	175	180	185	194	203	212	220	227	235	242
23	38	162	167	172	177	182	192	201	210	217	225	232	240
24	39	160	165	170	175	180	190	198	207	215	222	230	238
25	40	157	163	168	173	178	187	196	204	213	220	228	236
26	41	153	161	166	171	176	185	194	202	211	218	226	232
27	42	150	159	164	169	174	183	192	200	208	216	224	230
28	43	148	157	162	167	172	181	190	198	206	214	222	228
29	44	146	155	160	165	170	179	188	196	204	212	221	226
30	45	145	153	158	163	168	177	186	194	202	210	218	224
31	46	144	151	156	161	166	175	184	192	200	208	216	222
32	47	143	150	154	160	164	173	182	190	198	206	214	220
33	48	142	147	152	157	162	171	180	188	196	204	212	218
34	49	141	146	151	156	161	170	178	186	194	202	210	216
35	50	140	144	149	154	159	168	176	184	192	200	208	214

Values are based on properties of ammonia determined by Bureau of Standards, Washington, D.C. Actual temperature of gas discharged by the compressor should not exceed values given by more than 20 or 30 F. If this happens, something is wrong and plant efficiency is lower than it should be.

Vaporizing Equipment Enables Industrial Gas Burners to Handle Liquid Fuels

By C B HAMMERS
Southern California Gas Co

Designed for standby service, installation at the plant of Weber Showcase & Fixture Co, Los Angeles, serves as primary heat source because of wartime peaks on gas system

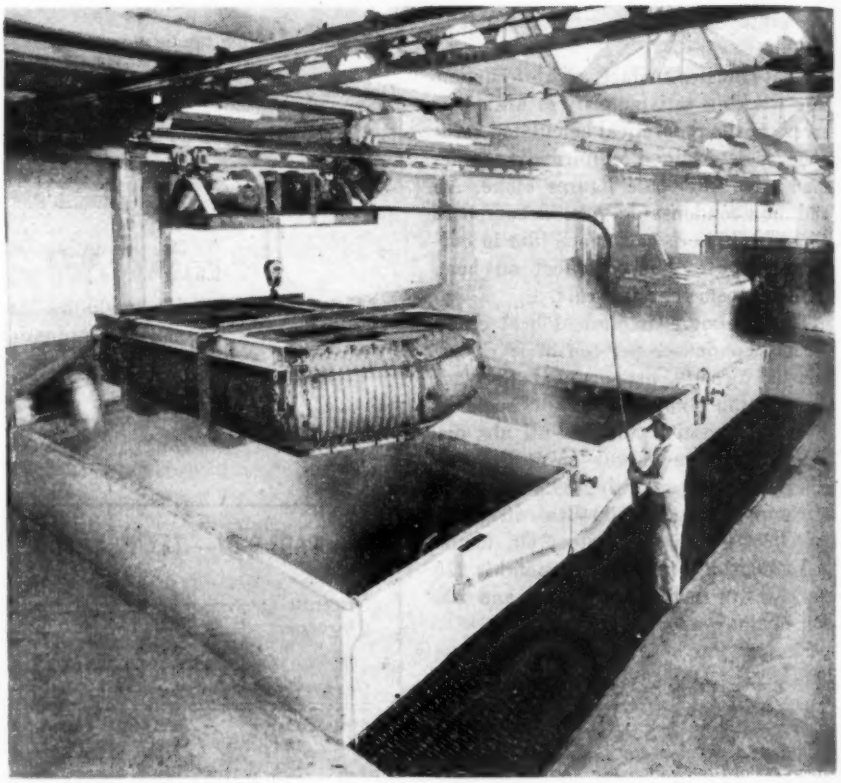

Fig. 1—Steel-compartmented life raft ready for parkerizing in solution tanks, heated by industrial gas burners fitted with vaporizing equipment for liquid fuel

► INDUSTRIAL GAS BURNERS of the premix type handle liquid fuel in a new installation at the plant of Weber Showcase & Fixture Co., Los Angeles. Designed as standby equipment, this system (patents pending) is being used as the primary heat source because of wartime peak demands on the distribution system of the local gas utility company.

The apparatus vaporizes liquid fuel in a stream of hot air, forming a completely combustible mixture. Naphtha serves as fuel in this case, but equipment of this type can be made to burn heavier oils, up to a No. 5 diesel oil. Since no change in burners is required to switch from a gas-air mixture to an oil-vapor-air mixture, the principle proves applicable wherever heat is required in a restricted space and both liquid and gaseous fuels are available.

Equipment Hookup

As shown schematically in Fig. 2, the system consists of a blower, air heater, fuel-metering basin and a mixing chamber in which fuel is vaporized and mixed with air in the proper proportions. Air from the blower passes through the heater, which raises temperature to about 300 F before air enters the venturi mixing chamber. By means of equalizing tubes, a pressure equal to the differential between the throat and the converging end of the venturi is imposed on the fuel in the metering basin. Pressure forces liquid fuel through a nozzle into the stream of hot air passing through the venturi. Because fuel pressure varies directly

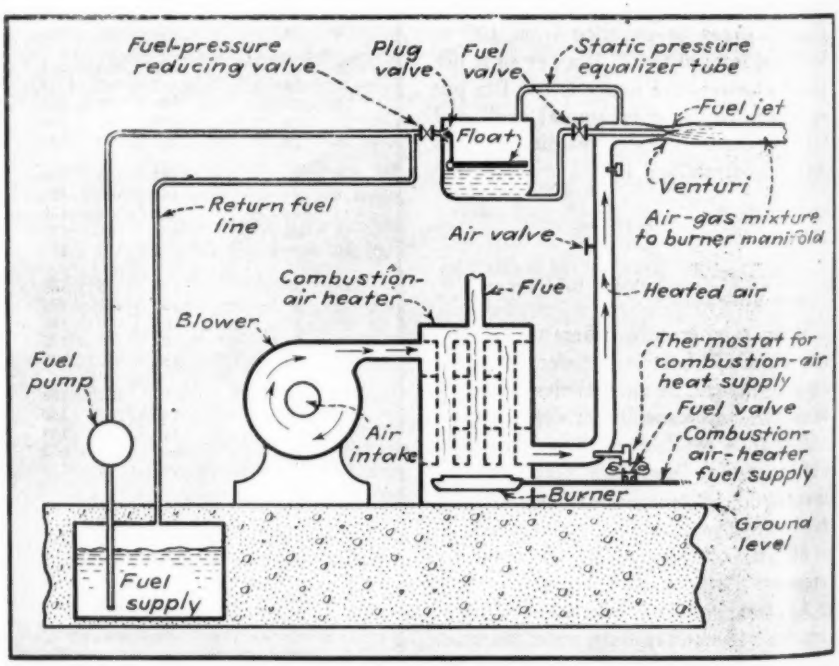

Fig. 2—Diagram shows heater and controls for 300-F air used to vaporize liquid fuel, venturi mixer, and equipment and controls for pumping and metering the fuel

with amount of air delivered through the venturi, an automatic proportioning effect is obtained. From the mixing tube, the mixture passes through a manifold to the inclosed burners. Flame characteristics resemble those of the ordinary gas-air mixture and a turn-down range of 8 to 1 makes no appreciable change in flue-gas analysis.

At the Weber plant, this equipment provides heat for two solution tanks that are used for Parko-processing metal life rafts. Fig. 1. Capacity of each tank is 12,500 gal, heated to about 200 F. Heat input of 2,000,000 Btu per hr comes from two burners in each tank, firing into submerged tubes which run the length of the tank (20 ft) along the lower inside corners and rise to vent into a breeching.

With tanks set in a pit, the burner equipment stands below ground level, Fig. 3. For this reason, and to minimize attendance, extensive use of automatic and remote controls has been made, centering in a panel on the ground floor, Fig. 4. Controls are in series and must be operated in the established sequence for starting. Failure of any component—fuel pump, blower or air heater—automatically shuts off main burners. Pilot for the gas-fired air heater is equipped with a flame-failure device and is lighted by electric spark.

A controller actuated by a thermostat immersed in the solution tank adjusts a butterfly valve in the fuel manifold just ahead of the main burners. Each burner has a flame-failure device and gas pilot. A master selector control on the instrument panel permits remote changeover from gas to oil without any physical change of burner or auxiliary equipment.

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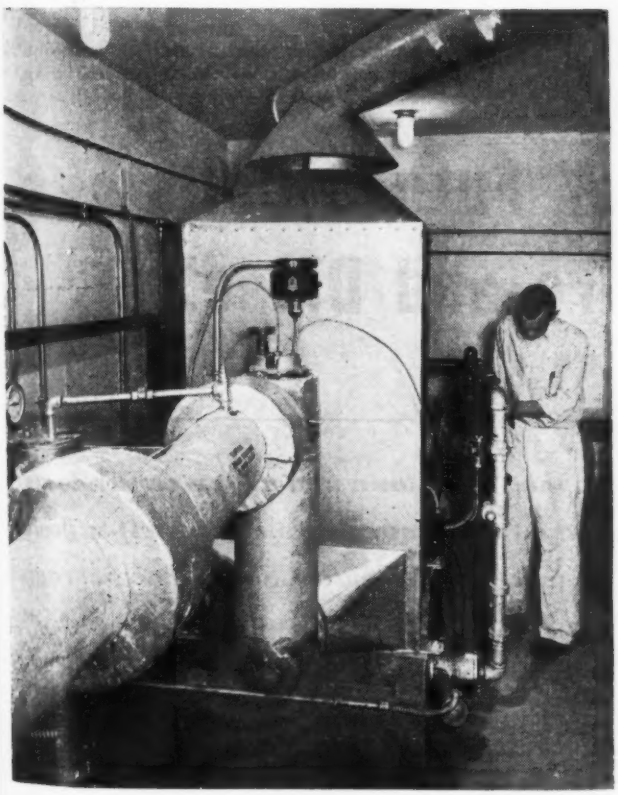


Fig. 3—Hot air from heater passes through mixer pipe, left foreground, where liquid fuel is introduced; the resulting combustible mixture burns in tubes immersed in solution tanks

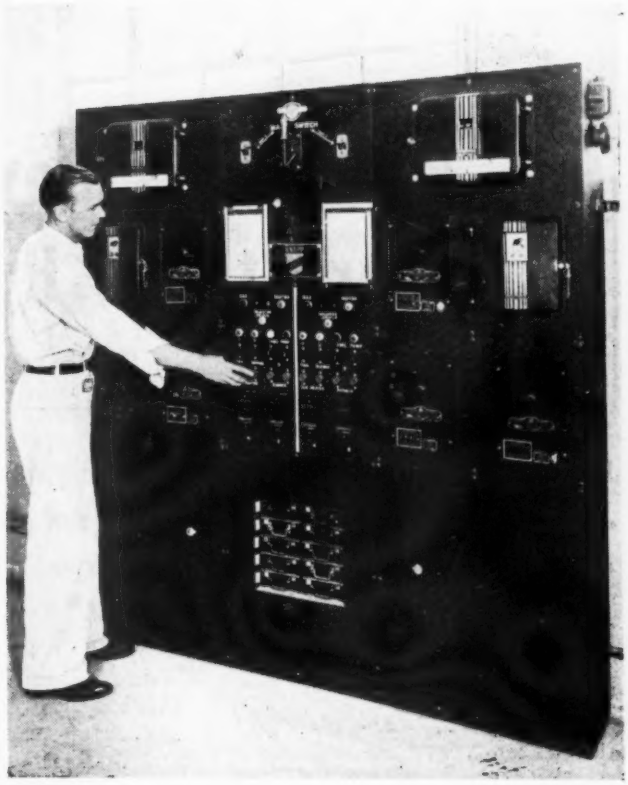
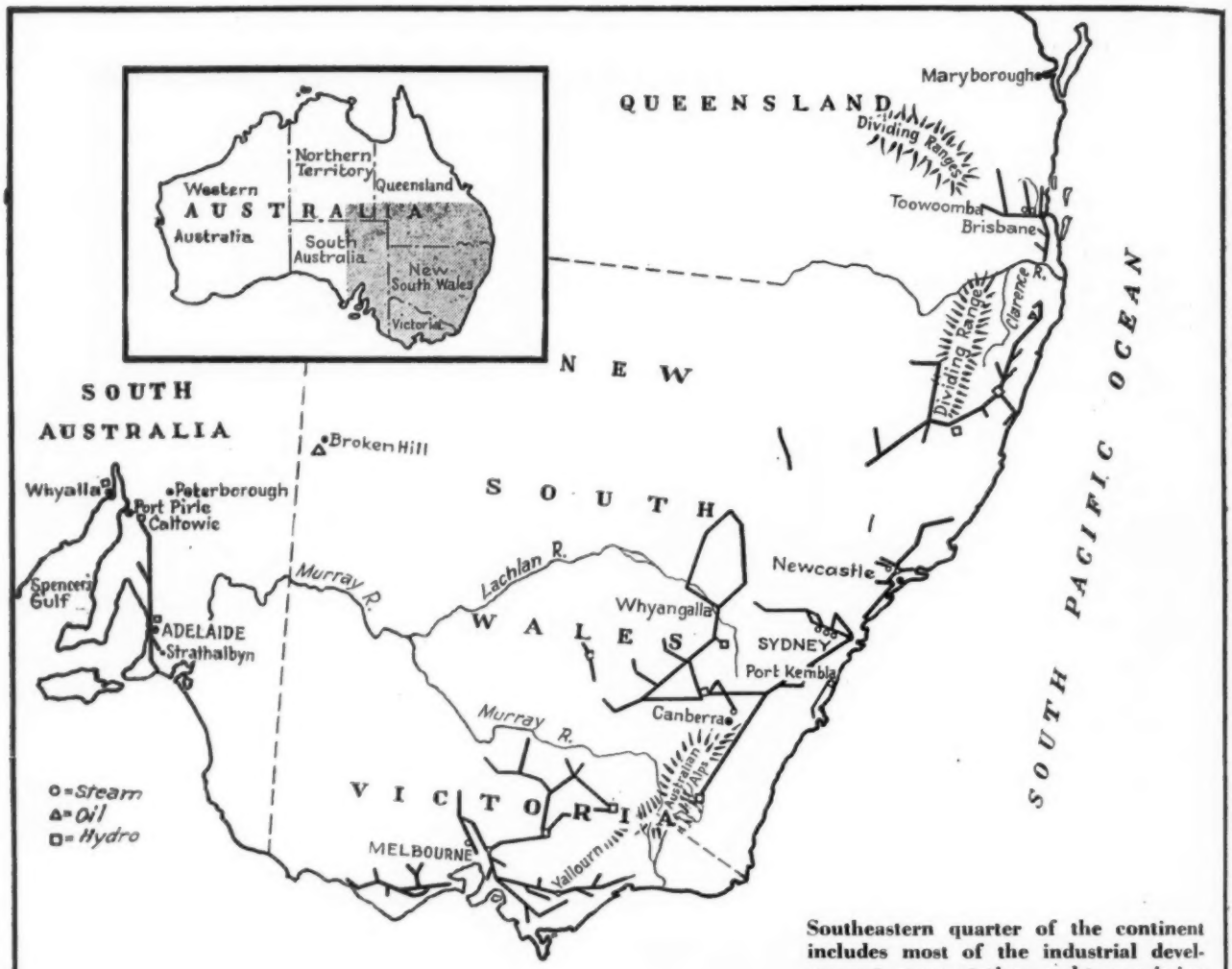


Fig. 4—Complete control for the heating equipment centers in this panel; auxiliary equipment and burners are located below floor, near bottom of tanks, approximately 10 ft deep



Southeastern quarter of the continent includes most of the industrial development, power stations and transmission lines, as shown by this electrical map

Australia's Power Future Calls For Steam, Hydro and Diesel

War has brought all-out industrial development to the "land down under," an erstwhile agricultural community. With steel, coal and power, the Commonwealth aims at a self-sufficient and prosperous postwar position as leading influence in the entire South Pacific region

By JOHN S G SHOTWELL

► ROUGHLY THE SIZE AND SHAPE of the United States, the Australian mainland has a population only that of New York City. Practically all centers of population are concentrated along a relatively narrow fringe of seacoast plain, mostly along the eastern and southern borders of the continent from Maryborough, in Queensland to Adelaide, near the steel district of South Australia. On the opposite, southwestern, coast are the well-known commercial cities of Perth and Freemantle, outlets for wool and agricultural products of the fertile western plain.

This distribution of population, primarily occasioned by settlement of fertile valleys along the coast and around natural harbors when the country was a purely agricultural and mercantile community, has had an important effect on Australia's industrial development. Industries first located around the head of Spencer's Gulf, Mel-

bourne and Sydney in the early years of this century. During World War I industry tended to grow in areas where power could be most easily and cheaply produced and supplied, with the result that industry is now concentrated in the southeastern sections of New South Wales and Victoria with a separate development around Spencer's Gulf.

Unfortunately, Australia is blessed with only a few good hydroelectric power sites. These are found in the mountains of the eastern coastal area, known as the Dividing Range, and on the island of Tasmania off the southern coast. Steam power, depending on extensive coal deposits (POWER, p 605, Sept. 1944), serves southern industrial centers and many of the coastal cities. Transmission networks are confined to local areas along the coast (map on facing page), and large areas of the country have no power or industrial development of any size. Small internal-combustion-engine plants serve lesser municipalities.

Steam Power Predominates

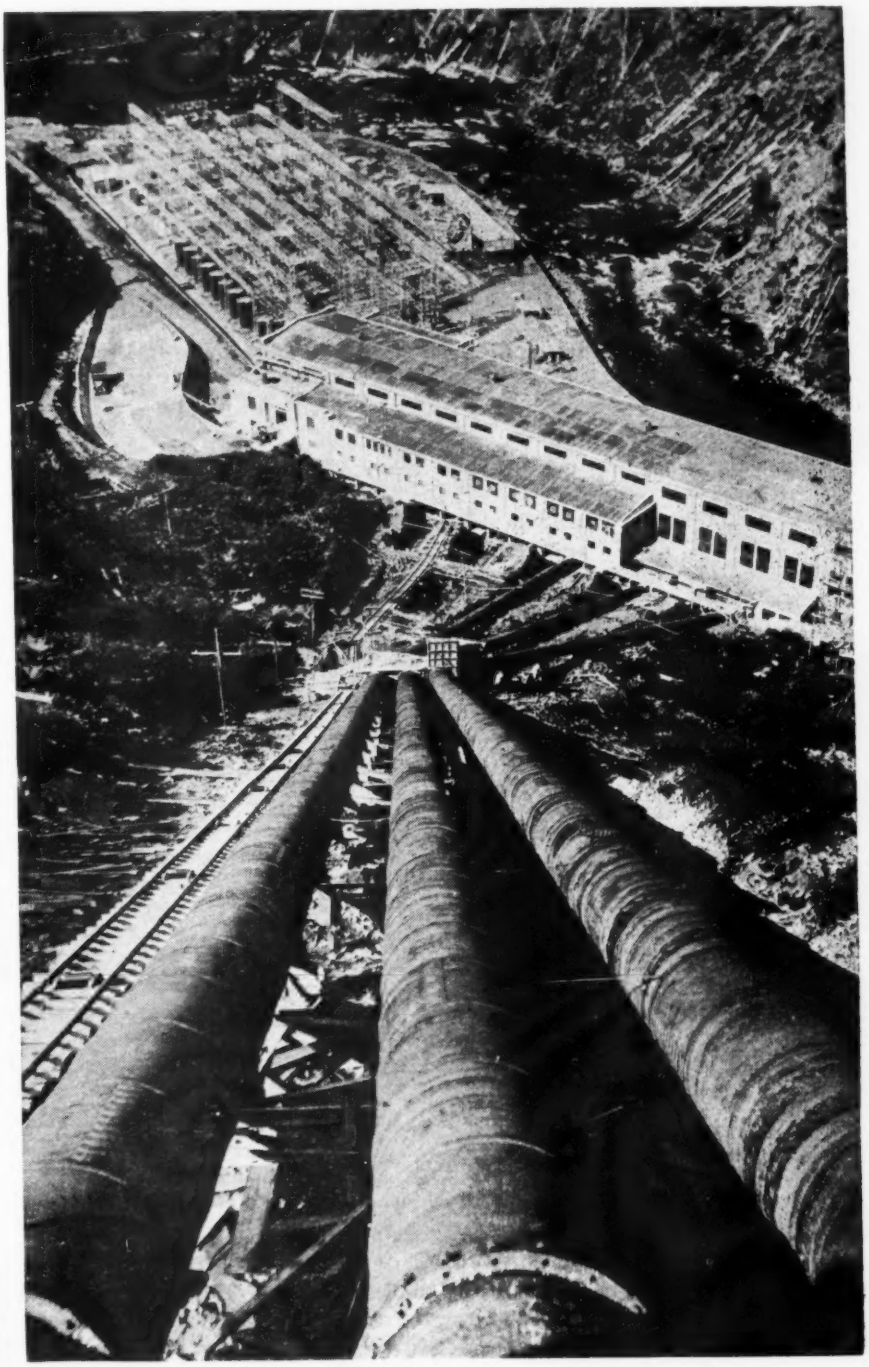
In 1936, capacity of generating stations in New South Wales totaled 631,000 kw of which 92% was steam, about 2% hydro and the remainder internal-combustion engines. In the same year Victoria had about 300,000 kw of generating equipment. While exact figures of present additions are not available, capacities have been greatly increased; more than tripled in Victoria and more than doubled in New South Wales.

Most power distribution is 3-phase 50-cycle, but some 3-phase 25-cycle is generated for traction purposes and a few industries. Direct current is also supplied for street and suburban railways around Sydney and Melbourne. Distribution voltages range from 240 to 415 v. Average load factor of most systems is about 50%. Generation of electricity in Victoria and New South Wales ranges around 1000 kwhr per capita.

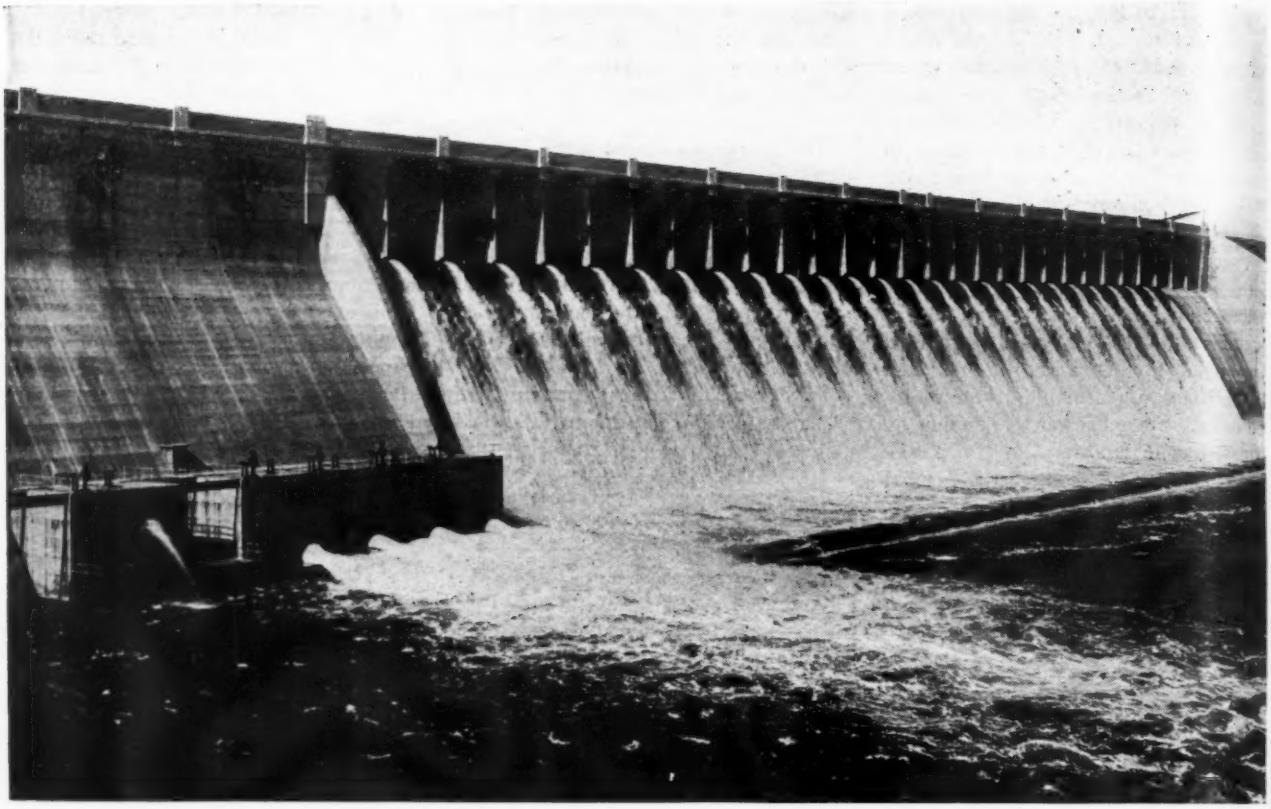
Most power development and distribution has been undertaken under some form of public ownership. The three principal examples of private ownership are the Electric Light and Power Supply Corp. which supplies part of Sydney's requirements, the City Electric Light Co, which supplies part of Brisbane along with most of the suburban and southeastern sections of Queensland, and the Adelaide Electric Supply Co, Ltd, which supplies the city of Adelaide and an area east of Spencer's Gulf.

The remainder of the large distribution services are under public ownership although some power is purchased from such industrial concerns as Broken Hill Proprietary, Ltd, at Newcastle. Map on facing page shows the relationship that now exists between power generation, transmission networks and centers of industrial population.

With increased transportation facilities and a general trend toward a broadening industrial base, the postwar power picture will probably change radically. In addition to projects in the southeast several good hydro power sites in the north may be developed within a few years of cessation of Pacific hostilities with accompanying construction of industrial establishments in areas now almost uninhabited. Water supplies have been found underground, which in addition to potential irrigation projects from existing watersheds, will assist a population increase to maintain itself. New mineral deposits, some exceedingly rich in quality and quantity, will undoubtedly lead to exploitation of



These penstocks lead down the slopes of mountainous Tasmania to a power development. Tasmania and New Zealand have extensive hydroelectric resources



Hume Weir, dam on the Murray River, impounds two million acre ft, largest conservation scheme in the southern hemisphere

many of the hitherto undeveloped areas.

Eight major generating and distribution systems now serve New South Wales, six primarily steam and two primarily hydro. More than two thirds of the installed capacity is steam generation concentrated in the vicinity of Sydney.

Looking toward the future, hydro development of the Snowy, Lachlan, Clarence and Styx Rivers in New South Wales has been studied. Like most Australian rivers, they have long periods of low minimum flow and thus require relatively large storage reservoirs, interconnection with steam plants, or both. No existing lakes provide suitable natural storage and the precipitation runoff is rapid. In the southeastern coastal area a snow region exists but the season is of comparatively short duration.

Hydroelectric Projects

The Snowy River project includes two power stations, No. 1 developing about 80,000 kw with an average gross head of 635 ft and No. 2, downstream, 170,000 kw with 1285 ft. From a storage reservoir at Jindabyne a 15-mile rock tunnel leads to two 2300-ft steel pressure pipes at Station No. 1. A 2000-ft tailrace tunnel in granite discharges into an intermediate pondage basin from which a one-mile tunnel leads to four 7300-ft steel pipelines at Station No. 2. Most of the power will be transmitted to Sydney at 220 kv with interconnections to the Burrinjuck and Port Kembla systems.

The Wyangalla Dam on the Lachlan River was completed in 1935 for irrigation, stock and domestic water requirements. About 10,000 kw can be developed at this site without interfering with irrigation requirements. Another 8000 to 10,000 kw can be economically developed on the Styx River by construction of a dam and relatively short tunnel. The Clarence Gorge project calls for a 5-yr development, totaling 75,000 kw and involving the largest dam in Australia.

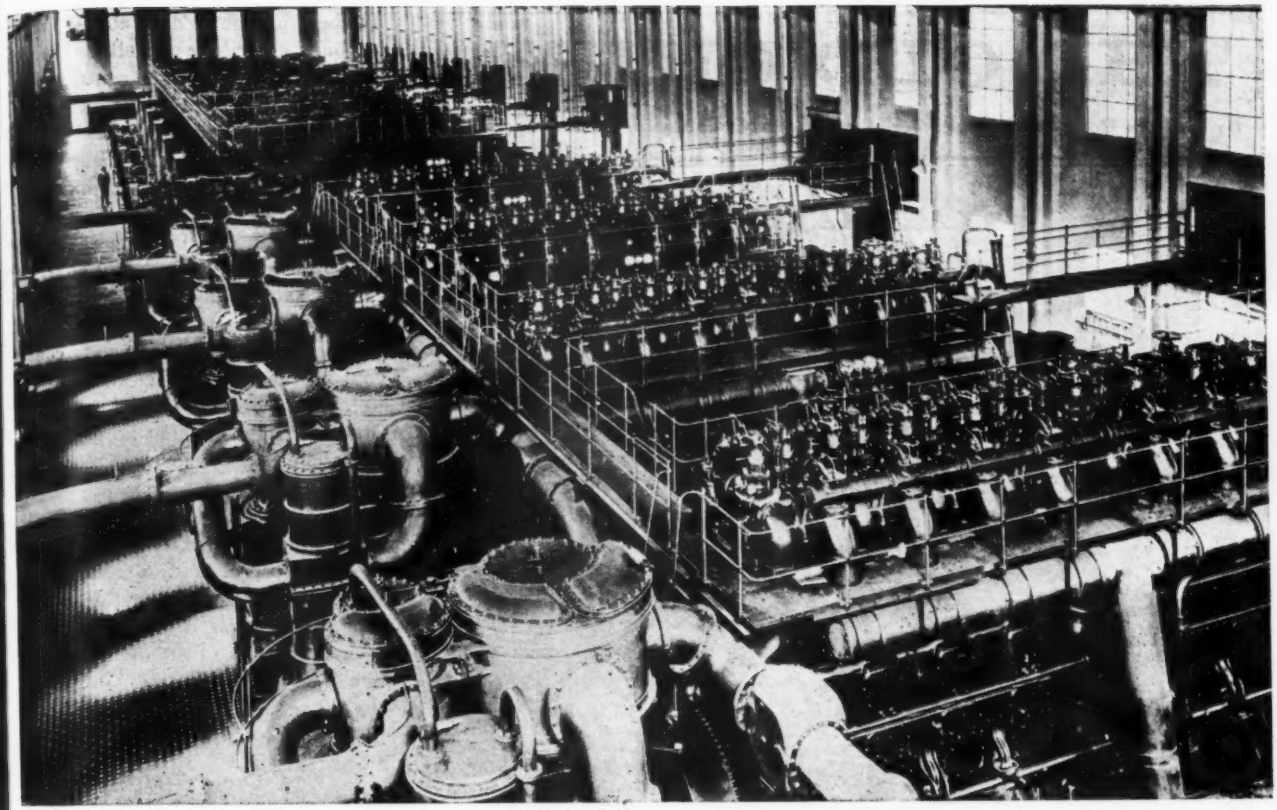
In Victoria, principal generating plants are located at Melbourne, Yallourn, Sugarloaf-Rubicon and Kiewa. Melbourne, Yallourn and another station at Geelong are steam plants, while the others are hydroelectric. The Sugarloaf-Rubicon system consists of five small power plants totaling about 30,000-kw installed capacity.

The Kiewa project is designed for ultimate installation of 104,000 kw of which the first 12,000 kw is now in operation and another 12,000 kw scheduled for completion by the end of 1944. So far the work has been concentrated in No. 3 station consisting of a dam on the East Kiewa River and a tunnel about a mile long under a ridge to provide a head of about 350 ft. Future plans call for four stages including two storage dams high up in the Australian Alps.

One dam on the Pretty Valley branch will hold 95,000 acre ft while a smaller storage reservoir on the Rocky Valley branch will contain 13,000 acre ft. On the West Kiewa a small dam and 3-mile tunnel will divert flow to a point on the East Kiewa below the junction of its two branches and ahead of No. 3 plant. Below No. 3 another tunnel will divert the flow back from East Kiewa to the West Kiewa to provide a gross head of 600 ft at No. 4 plant, which will have a capacity of 39,000 kw. Total river fall from storage reservoirs to No. 4 tailrace is about 4000 ft.

Features of Kiewa Project

An interesting feature of the Kiewa project is that the main dams and reservoirs are on one side of the mountain crest and the power plant on the other, water being brought through the mountain by a tunnel. Water is also to be used for an extensive irrigation scheme, the whole project to be operated jointly by the State Commissions for Electricity and Irrigation.

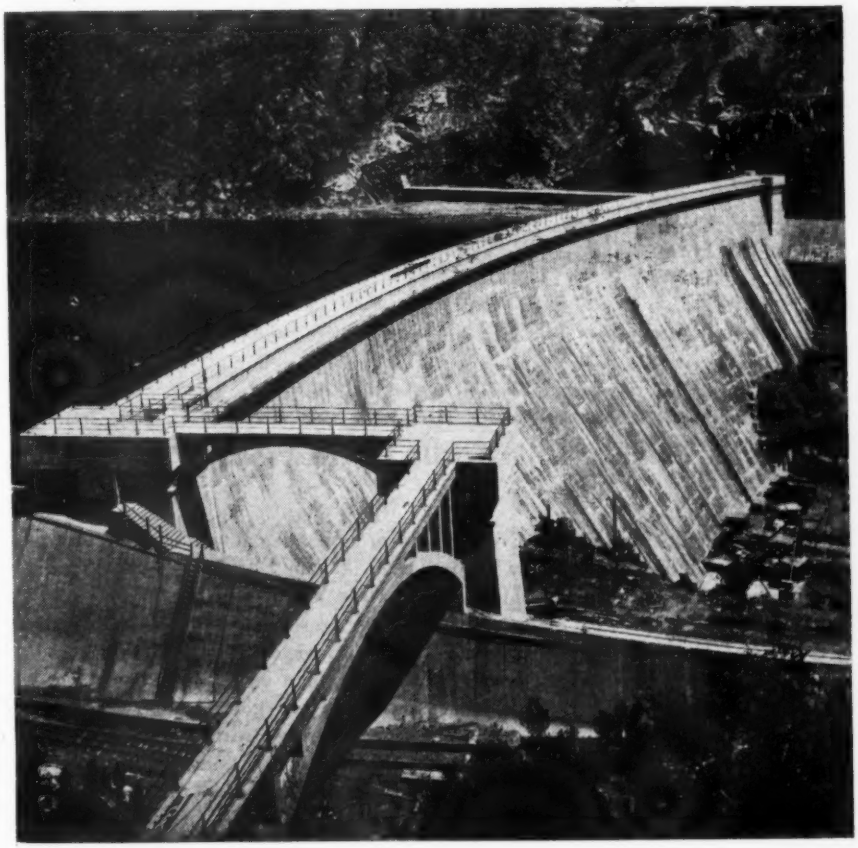


Six 3000-hp Sulzer and five 1250-hp Mirrelee heavy-oil engines at the Broken Hill Proprietary Co serve mining operations

In South Australia the only network system is that operated by the Adelaide Electric Supply Co, Ltd. A transmission system runs from Strathalbyn about 30 miles southwest of Adelaide to Caltowie, between Port Pirie and Peterborough. All the rest of South Australia is served by independent plants of which a majority are dc. Of the two important centers, that at Port Pirie is supplied by energy from Broken Hill Associated Smelters Proprietary and another at Whyalla supplied by Broken Hill Proprietary Co, Ltd, which owns this and the adjacent town of Iron Knob.

Mineral Resources Large

Whyalla, near the head of Spencer's Gulf, has become a most important steel center during World War II and will undoubtedly remain the principal source of raw material for Australia's postwar industry. Not only has the continent almost inexhaustible supplies of iron ore and coal, but sufficient amounts of practically all other metal ores are available either on the mainland, or as nearby as Tasmania and New Zealand. However, practically all petroleum must be imported, although this is not a serious problem in peacetime considering the proximity of the oil fields of the East Indies.



Typical of the combined power and irrigation projects characterizing much of the recent and proposed Australian development is Burrinjuck Dam in the Murrumbidgee Irrigation district of New South Wales. 20,000 kw capacity is now installed

THE OLD CHIEF

By William Doran, chief engineer, Essex County Sanatorium, Ont., Canada

LANDMARKS.

Presentation gifts at the farewell party seldom varied

Fashions change in watches and professional training but an engineer's landmarks are still service, safety and loyalty

In recalling incidents that occurred in the old plant, I find particularly fresh in my memory the happenings that were linked to a social function of one kind or another. Farewell parties cropped up from time to time when some member of the staff decided to try his luck elsewhere. On these occasions we all subscribed for a parting gift and invariably the event was marked by a party in the home of one of the engineers.

These send-off parties were known to us as payoffs, a name that may not be familiar in some districts. I think the term is handed down from older times when a man leaving a job paid off by treating all his friends.

The presentation gifts that we made seldom varied. It was a tradition that a young man on leaving should receive an inscribed gold watch, large and heavy, together with a chain of equally ponderous proportions. If the recipient was a married man or one about to venture on the seas of matrimony, the gift was invariably a large cruet stand with four cut-glass sauce bottles. Variations from this order lay between a gold stickpin and a brass-bound album.

In these pre-movie days almost everyone could contribute something in the entertainment line and the contributions seldom varied. I bet I heard Scottie Martin sing at a dozen parties and his song was always "Annie Laurie." I have heard Slim Wilson play his violin solo as many times and always it was "The Last Rose of Summer." Even the refreshments were traditional; in summer, salad sandwiches, ice cream and Boston sherbet; in winter, chicken sandwiches, drop cakes and coffee. About the last to arrive was the Old Chief, who chatted around for a while. At just the right moment he performed the presentation ceremony, which in itself was traditional.

There was a reference to the "unanimous wish of all your fellow employes," "token of respect and esteem," "look back in years to come on this symbol of the good wishes," etc, etc. After the presentation most of the older folk left, which was the signal for the carpet to be taken up and square dancing to commence.

The Letter

Earlier on the same day another tradition took place in the old plant. The man who was leaving was relieved about two hours before the usual quitting time and told to report to the Old Chief's office. There the two sat until long after we had gone home. I often wondered what took place at that conference and one day I found out. I had decided to leave the old nest myself and take a job in charge of a small plant in a nearby town. When the day came for my call to the Old Chief's office I found him writing my recommendation in his large, round hand.

He chatted about my prospects and then went on to speak of what he called the landmarks of our calling, *service*, *safety* and *loyalty*. Service at all times, come strikes, hell or high water. Safety, first and last: to have a healthy respect for pressure vessels in our care and never for a moment to countenance anything contrary to, or subversive of the Code and regulations laid down for our guidance. Loyalty to fellow engineers by ever seeking to enhance the status of all engineers. Loyalty to employers by never revealing any confidential knowledge of their business that might come within the engineer's ken.

He advised me to resign myself to the fact that study was the lot of every engineer. No combustion man should stop short of quantitative chemistry and an engineer should never have to apologize for his drawings.

(*Continued on page* 194)

More Power, More Water for California: Shasta Goes Into Operation

SHASTA DAM and its powerhouse, photographed above, are part of one of the world's largest water-power and conservation projects. A general picture of this Central Valley project, on the Sacramento River in northern California, is diagramed at top of page 98. It is a long-range $330,000,000 development, being built by the U. S. Bureau of Reclamation, which includes power generation, flood control, salinity control, river regulation, navigation and irrigation.

Rising near Mount Shasta in northern California, the Sacramento River flows south into San Francisco Bay. Coming up from the south, the San Joaquin River empties into the same bay. There is an excess of water in the Sacramento River and a deficiency in the San Joaquin. The Central Valley project is designed and being built to correct this condition.

Shasta Dam, the main element of the development, is a concrete gravity design, with crest length of 3500 ft, maximum height of 560 ft. It contains 6,000,000 cu yd of concrete and will provide 4,500,000 acre-ft water storage. In size, this dam ranks next to Grand Coulee, which is 4500 ft long, 553 ft high, 550 ft thick at base, contains 11,250,000 cu yd of concrete, and impounds over 10,000,000 acre-ft of water. Boulder, the highest dam built, is 727 ft high. It has a crest length of 1244 ft, is 660 ft thick at the base, contains 3,250,000 cu yd of concrete, and has a water-storage capacity of 31,142,000 acre-ft, more than three times that of Grand Coulee and seven times that of Shasta.

A powerhouse near Shasta Dam will have five 75,000-kw power-generating units, two of which started operation July 14 of this year. A few miles below Shasta, Keswick Dam, 148 ft high, now completed, regulates river flow to permit more latitude in water use for power generation at Shasta plant. Water flow by Keswick, other than over its spillway, will be through the waterwheels of three 25,000-kw units, not yet installed because of war restrictions.

For the present the Bureau of Reclamation will sell Shasta Dam power to Pacific Gas & Electric Co for distribution in its system. Power will be taken into its system at two points: its Shasta substation, 28 miles from Shasta plant, and Oroville at the end of a 100-mile 230-kv line, built by the Bureau but leased by it to the power company.

Water from the Sacramento River's lower delta region will be carried by a 10,000-cfs canal and pumping plant up the San Joaquin Valley where the water table has dropped as low as 250 ft in places. Friant Dam, with 520,000 acre-ft storage, and its system of canals will further augment the San Joaquin Valley water supply. Dam operation, including 415 miles of canals, and four pumping stations, will require 150,000 kw when completed.

The 103,000-hp 138.5-rpm 330-ft-head waterwheels in Shasta power plant are Allis-Chalmers; the 75,000-kw generators, General Electric; two 3500-hp service-unit waterwheels, James Leffel & Co; the main 25,000-kva, 13.6- to 132.8- and 230-kv transformers, Westinghouse Electric & Mfg Co; waterwheel governors, Woodward Governor Co.

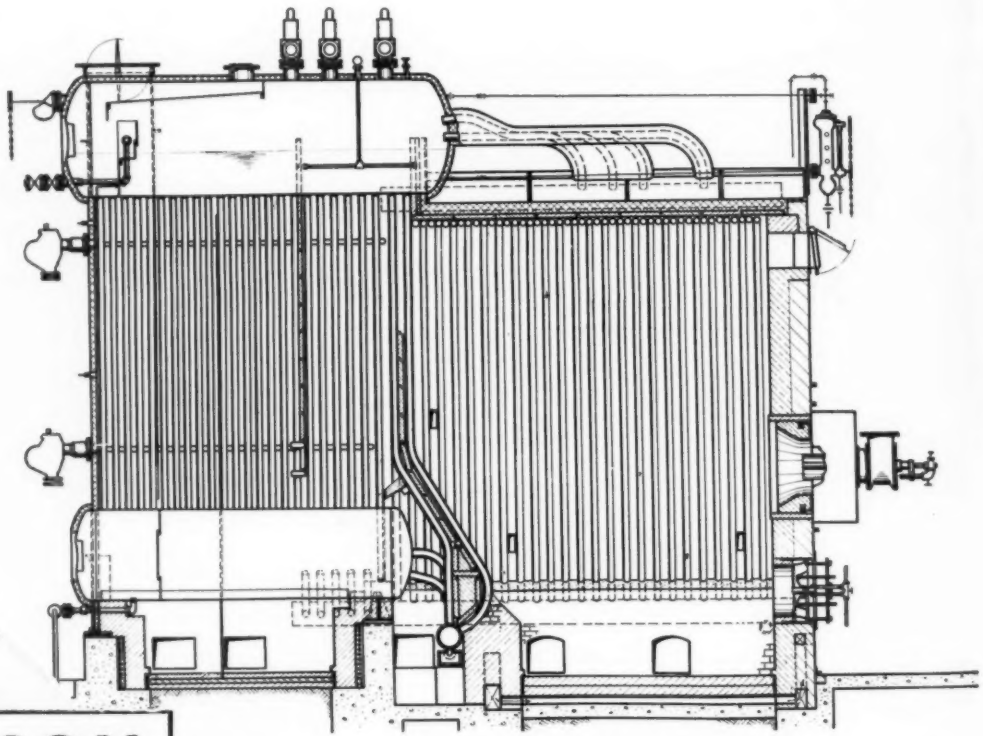
(*Continued on page* 98)

NICHOLSON FILE obtains excellent

Nicholson File Company, one of the country's leading manufacturers of files, recently installed 3-30,000 lbs. per hour Riley "RO" boilers fired by either pulverized coal or oil. The units operate at efficiencies of 82% without heat recovery equipment other than the distinctive Riley "RO" boiler integral economizer. At 30,000 pounds of steam per hour, exit gas temperatures are down to 500°F.

The Riley units have proved entirely reliable and satisfactory. Ratings of between 35,000 and 40,000 pounds of steam per hour are obtained without difficulty and at high efficiencies.

It has been proven by actual field results at hundreds of plants that the Riley "RO" unit is the ideal unit for steam capacities of from 10,000 to 100,000 pounds of steam per hour. The water-cooled furnace, integral economizer and steel clad insulated setting assure reliable, outstanding, efficient performance. It pays to install Riley "RO" Boiler units because of the low cost of producing steam with these efficient units.



NICHOLSON FILES *FOR EVERY PURPOSE* NICHOLSON U.S.A. MADE IN U.S.A.

NICHOLSON FILE COMPANY, Providence, R. I.
3-30,000 lbs./hr. Riley "RO" Boiler Units, Pulverized Coal and Oil Fired
Operating Pressure, 125 lbs. Saturated, Jenks & Ballou, Engineers

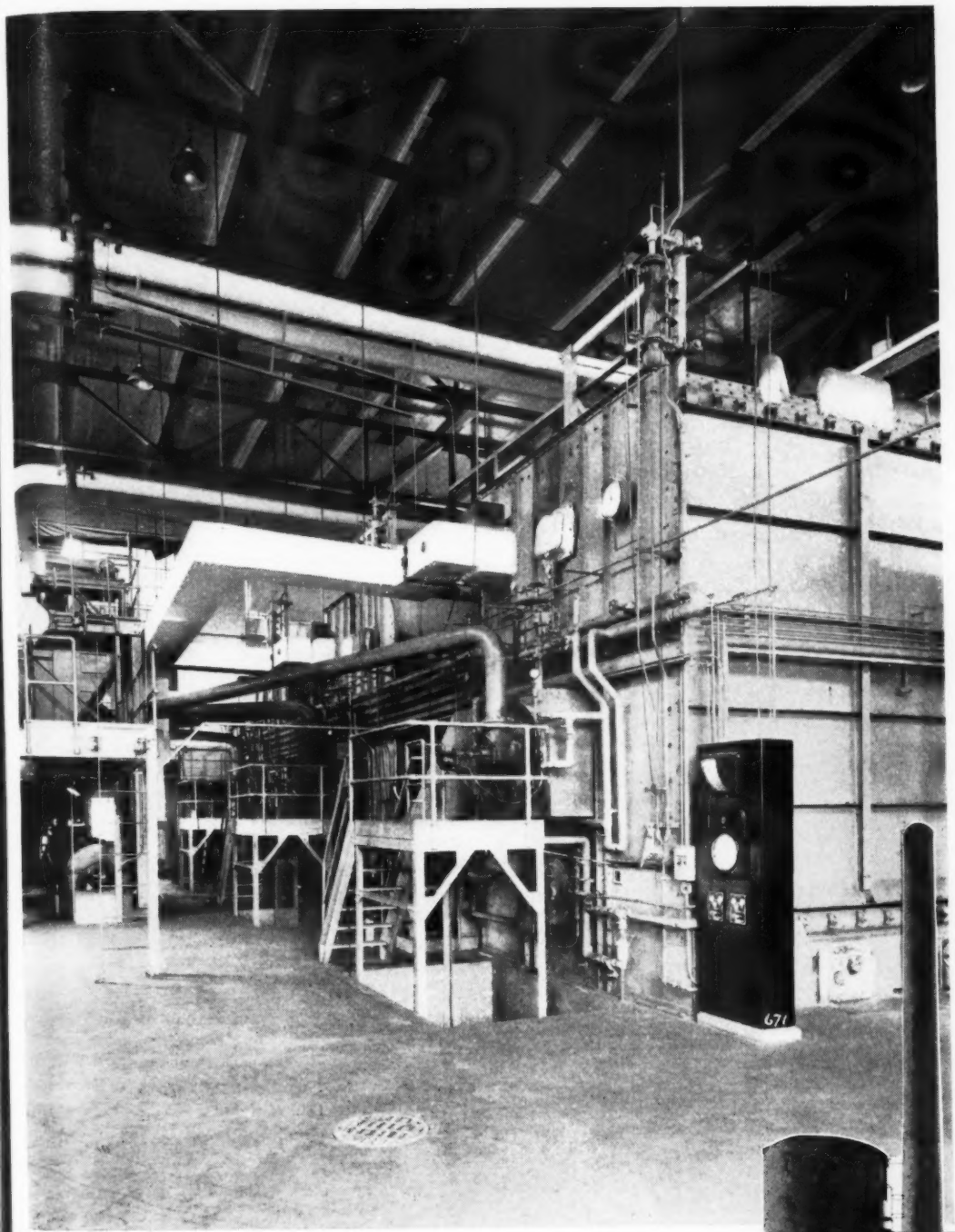
RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston New York Philadelphia Washington Buffalo Cleveland Detroit Chicago St. Louis Cincinnati
St. Paul Kansas City Denver Seattle Portland Los Angeles Houston New Orleans Atlanta Memphis

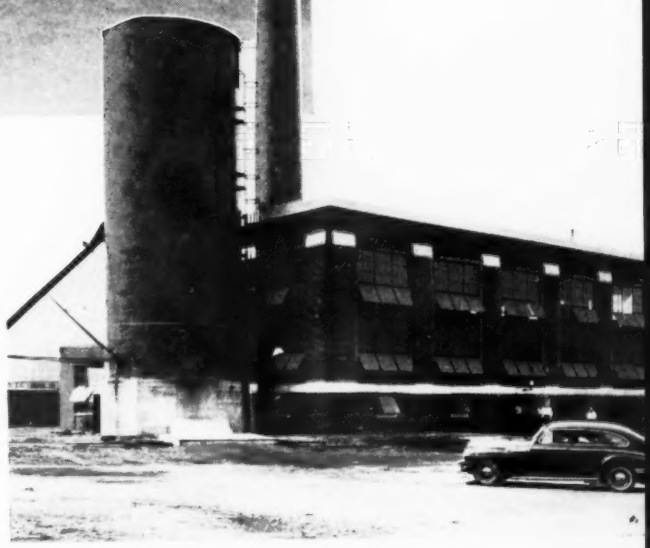
It will pay you to visit modern Riley Installations

results from RILEY "RO" BOILERS



New Boiler Plant, NICHOLSON FILE COMPANY, Providence, R. I.
3-30,000 lbs./hr. Riley "RO" Boiler Units, Oil and Pulverized Coal Fired. Jenks & Ballou, Engineers

A survey of your power plant by a consulting engineer will possibly show ways of making surprisingly large savings in power costs



BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS

COMPLETE STEAM GENERATING UNITS

AIR HEATERS • ECONOMIZERS • WATER-COOLED FURNACES

STEEL-CLAD INSULATED SETTINGS • FLUE GAS SCRUBBERS

before purchasing Boiler or Fuel Burning Equipment

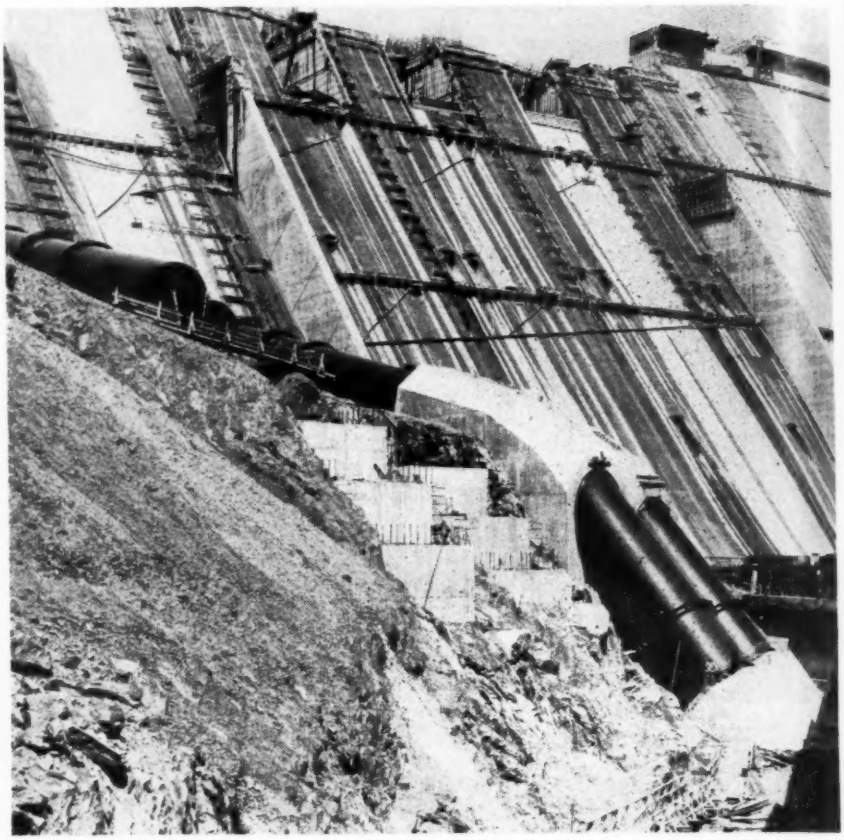
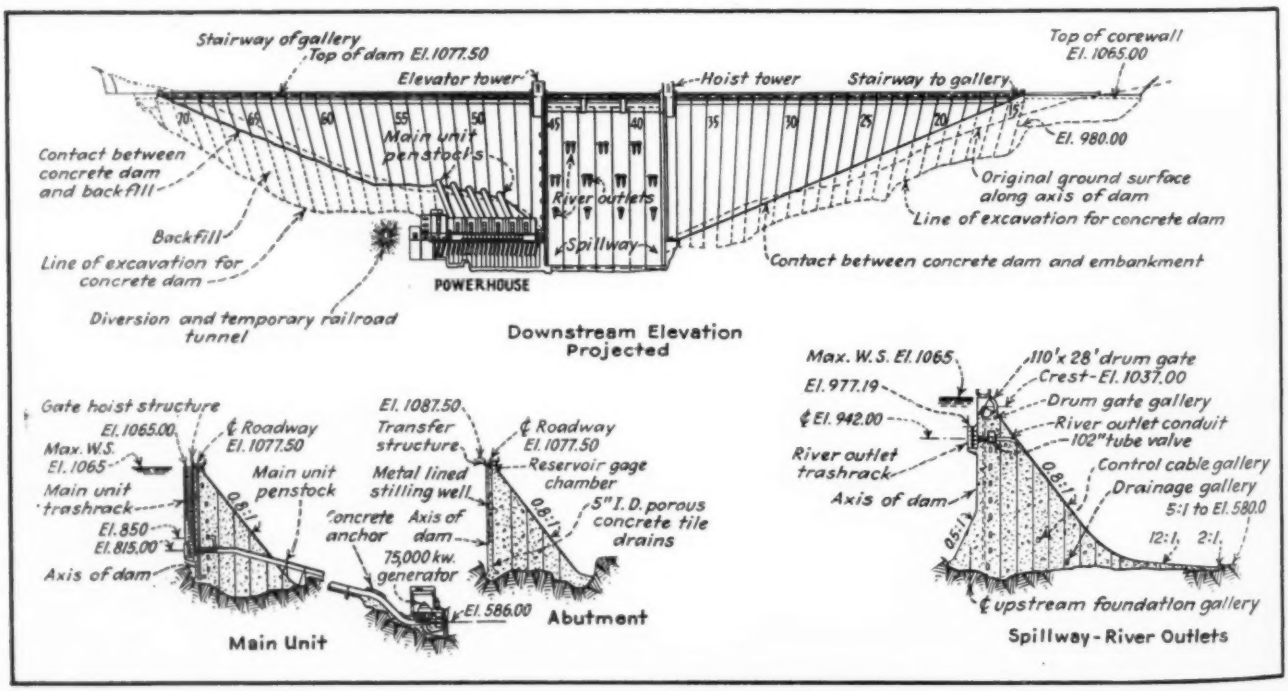


DIAGRAM of $330,000,000 water-power and conservation project in California. Water stored back of Shasta Dam will generate power in Shasta and Keswick power plants, then flow down the Sacramento River to its delta region. From there it will be taken to irrigate the San Joaquin Valley where there is a water deficiency. Friant Dam, with its 520,000 acre-ft reservoir and four pumping plants, requiring 150,000 kw to operate, will further augment the limited water supply of San Joaquin Valley.

SECTION of Shasta Dam, (above right) when it was under construction, showing two of the five 15-ft diameter 800-ft-long penstocks that conduct water to 103,000-hp 138.5-rpm 330-ft waterwheels in the power plant.

DOWNSTREAM ELEVATION and cross-sections (below) through Shasta Dam, 3500 ft long and 560 ft high. At the top of the spillway section three 110-ft drum gates, 28 ft high, will handle a 190,000-cfs flood. Eighteen 102-in. outlet pipes, with valves through the spillway section of the dam, permit bypassing water around the powerhouse when water level is below the crest.



SHASTA POWERHOUSE will have five 75,000-kw 1.0-pf 13.6-kv 60-cycle generators: The two shown on the left are now in operation. Two more units diverted to Grand Coulee for the duration will be removed and installed in Shasta after the war, according to present plans. A fifth unit will be installed as soon as materials are released for its manufacture to give the plant a total capacity of 375,000 kw.

A thrust bearing above each generator supports the total weight of the rotating element—generator rotor and waterwheel runner. In addition to five main generators, there are two 2500-kw waterwheel-drive house-service units. Control of the plant centers in two control rooms. Turbine control, governors and auxiliary power boards, in a room on the generator floor, are connected by communication systems to the main switchboard room some distance away in an upper corner of the plant.

SHASTA DAM (below), looking at the downstream side as it nears completion. The five 15-ft penstocks extending about 800 ft from dam to powerhouse can be seen in the left center. Second largest structure ever built, the dam contains 6,000,000 cu yd of concrete, and will impound 4,500,000 acre-ft of water, more than the annual runoff from 6600 sq miles of drainage area. This dam stores water for irrigation, flood control, salinity control, river regulation, navigation aid in the Sacramento River and power generation. It will also supply water for irrigation in the San Joaquin Valley. In Shasta and in the Keswick plant, 8 miles farther down the river, a total of 450,000-kw generating capacity will be installed to generate an estimated output of 1,500,000 kwhr annually.

(*Continued on page* 102)

Let's Get Down to FUNDAMENTALS

PATERNAL ANCESTOR

ONCE UPON A TIME there was a little Steam Trap that ventured forth into Topsy Turvey land to find a place to live. But when he got there, other steam traps told him, "You'll never do here. You have too many moving parts. Your fittings are all wrong. You are too simple. And besides that, your ears are too long!"

Perplexed, the little Steam Trap returned from Topsy Turvey land and went direct to Great-great-great-grandad Steam Trap. "Sire," said he, addressing the venerable one, "Aspersions have been cast upon my ability to whistle like a peanut vendor's wagon. Pray please tell me again: just what is it that I'm supposed to do?"
Here is what the old boy told him:

I

A TRAP MUST DISCHARGE WATER

a. The orifice should be large enough to take care of peak loads easily regardless of the operating pressure.

b. The trap should be able to handle condensate at any temperature—cold, warm, or at steam temperature.

c. Actual condensate capacity ratings are necessary. Calculated capacities or cold water tests are of no value. Armstrong's capacity table shows what Armstrong traps will handle when the condensate is at steam temperature.

BEWARE OF CAPACITY RATINGS

II

TRAPS SHOULD PREVENT LOSS OF STEAM

a. When the Armstrong bucket is 2/3 full of steam it floats and closes the valve.

MAKING PERFECT CONTACT WITH SEAT

b. The Armstrong valve will close tight in any position because it is a perfect hemisphere and always makes a perfect contact with its seat.

c. The Armstrong valve will continue to make perfect closure because both valve and seat are made from heat-treated chrome steel that is very hard and tough.

d. The Armstrong Trap does not require adjustment in order to function properly.

e. The Armstrong Trap will discharge condensate to, but hold steam against, the highest vacuum obtainable.

III

A TRAP SHOULD BE ABLE TO DISCHARGE AIR

a. In the Armstrong Trap, air escapes through the vent in the inverted bucket. This vent is always open to handle air at any temperature.

VENT OPEN

b. Large vents, thermostatically controlled, can be furnished for Armstrong Traps to drain jacketed kettles, syphon-drained rolls, etc. These large air vents can be adjusted to close at any required temperature.

THE ARMSTRONG TRAP PRIMER

IV

A TRAP SHOULD BE ABLE TO OPERATE UNDER BAD WATER CONDITIONS

a. Any oil present with the condensate will rise to the top of the Armstrong trap body and be discharged first.

b. There are no dead spots in the Armstrong trap body in which dirt or sludge can settle.

DEAD SPOTS

c. All parts in an Armstrong Trap are made of stainless steel which resists corrosive liquids.

V

A TRAP SHOULD REQUIRE LITTLE MAINTENANCE

a. The Armstrong Trap has only two moving parts —the bucket and the lever assembly. There are no pivots or cotter keys.

FRICTION-LESS OPERATION

b. Frictionless operation insures long life of parts in an Armstrong Trap. There are no sliding contacts or variable clearances to affect the power of the bucket to open the valve.

c. The Armstrong valve opens wide and closes tight. This prevents wire-drawing and scoring of valve.

d. There are no parts that can be damaged by excessive pressure.

VI

A TRAP SHOULD BE EASY TO USE

a. The Armstrong Trap is light in weight and small in size—particularly on the basis of capacity.

b. The position of connections fits in well with standard practice and permits simple installations regardless of what the requirements may be.

c. Each trap is equipped with a handy test plug over the discharge orifice.

TEST PLUG

d. Care is taken to prepare literature that answers every possible question a user might have about the application or installation of Armstrong traps.

VII

A TRAP SHOULD HAVE RESPONSIBLE BACKING

a. The success of the Armstrong organization depends entirely on the performance of the Armstrong Trap. Under such circumstances, it is only natural that great care is excercised to make sure that every customer is satisfied and that every claim is fulfilled.

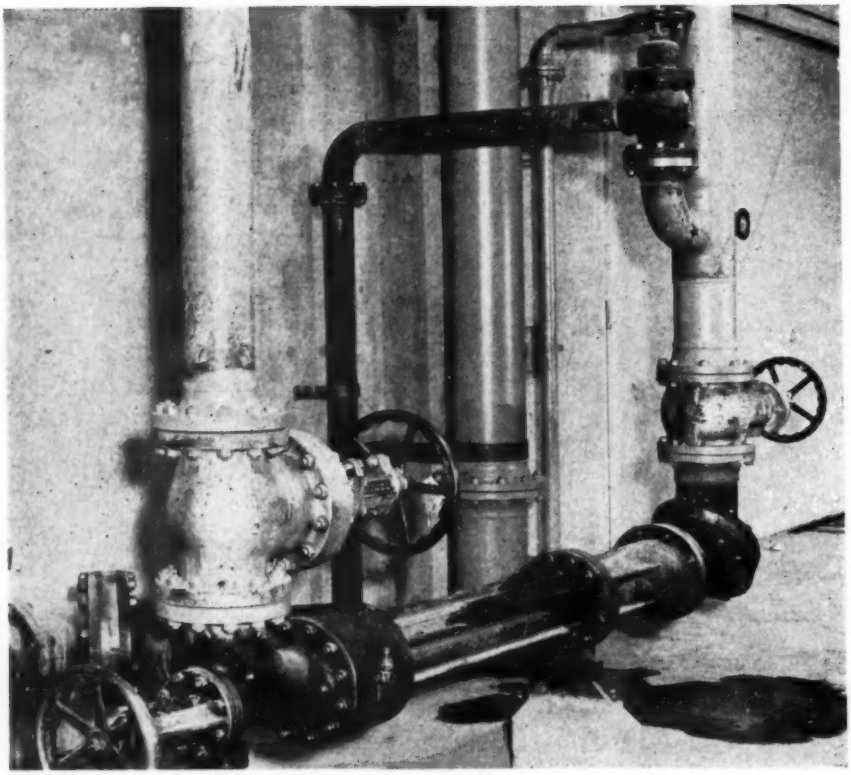
EXERCISING CARE

b. Armstrong representatives subscribe whole-heartedly to Armstrong policies. Many of them have built their business entirely on the success of Armstrong Traps.

c. The Armstrong guarantee of "Complete Satisfaction" means just that!

P.S. Points listed here are discussed in detail in the new Armstrong Steam Trap Book. If you would like to read this book, drop us a line and we will send you a copy.

ARMSTRONG MACHINE WORKS
Three Rivers, Michigan
808 Maple Street

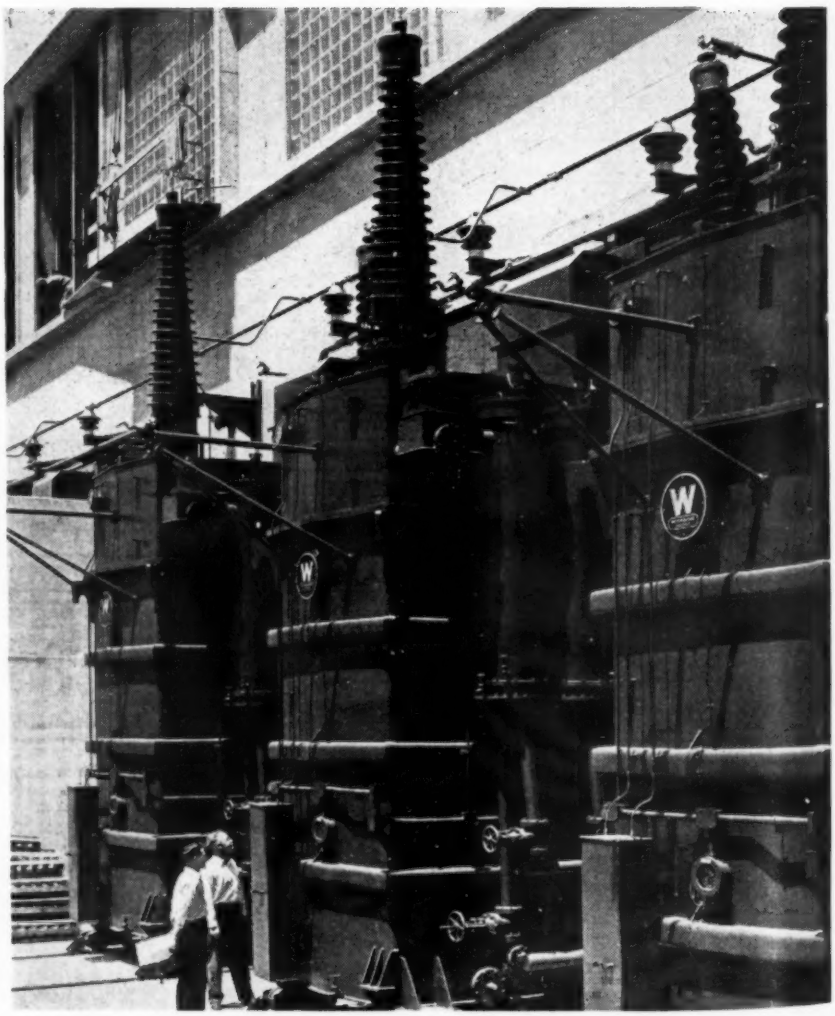


More Power, More Water for California: Shasta Goes Into Operation

(*Continued from page* 99)

JET OR EDUCTOR-TYPE pump supplies water for Shasta generator heat exchangers and transformer cooling. In this pump the vacuum or cavitation created by a high-head jet of water discharging within a chamber draws in a large volume of low-head water, and discharges it to the generator and transformer cooling systems.

Developed by engineers of the United States Bureau of Reclamation, this inexpensive pump was first used in the power plant at Boulder Dam.



GENERATOR TERMINALS connect directly through bus duct without circuit breakers to low-voltage terminals of the main transformer bank. Each bank contains three 25,000-kva, 13.6- to 132.8- and 230-kv transformers in cells along the tailrace side of the powerhouse. A gantry crane operating on a concrete roadway serves the transformers and handles the tailrace gates. Transformers are water cooled, external radiator design, with forced oil circulation. Each generator has its own bank of transformers with 230-kv leads spanning the tailrace and river to a switch station before transmission. Duplicate 3-phase transformers step down the 2300-v house generator output to 440 v for auxiliary power, and to 120-240 v for lighting. A 2500-kva transformer supplied from a 13,600-v auxiliary bus that can be energized from any one of the main generators provides standby house-service power for auxiliaries.

RUSSIA

Threat . . . or Promise?

WHEN this war is ended, two nations—the United States and Russia—will possess the bulk of the world's military and industrial might.

Whether this new situation will hold seeds of catastrophe or of unprecedented opportunity will be determined by policies . . . still to be formulated.

If this concentration of power leads to a bitter struggle for supremacy, then the world will be turned into a giant munitions factory.

If it is used cooperatively to maintain order, then, I believe, the stage is set for a long era of prosperity . . . and peace.

It is time that Americans, whether of the Right or the Left, face this basic issue squarely and open-mindedly.

☆ ☆ ☆

No group in this country has a greater stake than have business and industry in seeing that a satisfactory Russian-American understanding is reached.

Without such an understanding there can be no reasonable hope for more than a temporary and insignificant reduction of our crushing wartime tax burden. If the threat of a clash between these two giants impends, neither bankers nor governments will run the risk of lending on a scale adequate to maintain international trade at levels necessary for our future prosperity. Potential international customers, instead of buying freely in open world markets, will be forced—as during the dangerous period introduced by Hitler in the early 1930's—into the trading camp of whichever power they fear most.

If, however, Moscow and Washington will agree on cooperative plans for maintaining the peace, American business will enjoy enormous new trade opportunities after the war.

☆ ☆ ☆

Russia, during the three and one-half years since it was attacked by Hitler, has conclusively proved to a doubting world that it is a top-flight military power.

Soviet railroads did not break down under the strain of war.

Regions accounting for nearly 70 per cent of Stalin's key industries were engulfed by the invading Nazis, but before they fell, Soviet management engineers performed a near miracle by transplanting entire industries a thousand miles to the Urals with the loss of as little as four months' production in many cases.

Though American planes, trucks, and medical supplies have been welcomed by Moscow, fairness demands the admission that more than 98 per cent of American production has *not* gone to the Russian front.

Russian planning and *Russian* equipment won the victories of Leningrad, Stalingrad, and the Caucasus.

☆ ☆ ☆

But these measures of Soviet military strength—indicative as they are of an unsuspected economic development—fail to picture in adequate detail the startling potential of the Russian market after the war.

Russia, for instance, has two and one-half times the area of the United States.

It has a population of nearly 200,000,000, and this is increasing at the rate of 2,500,000 a year.

And statistics just released show that Russia has three times as many youngsters under 16 as has the United States. This is a measure both of war potential and of a vast commercial market.

And remember that in no part of the world before the war was per capita production rising as rapidly as in the Soviet Union.

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German armies occupied a region in Russia roughly equivalent to the territory in the United States north of Richmond, Virginia, and east of the Mississippi.

This huge area—with its counterparts of Pittsburgh, Buffalo, and Bridgeport; of Illinois corn fields, New York dairy farms, and Maine potato harvests—was *twice* subjected to the most withering destruction; first by the Russians themselves when they retreated before the Germans, and then by the Germans when they withdrew before the victorious Russians.

As a result, 30,000,000 people are in urgent need of complete reoutfitting. They need houses and shoe laces, trolley cars and baby carriages, tractors and livestock, hydroelectric plants and electric light bulbs.

Many of these needs will be met at home. It is doubtful, for instance, if Moscow will import cooking utensils or sewing machines, for many of Russia's huge war factories can quickly be converted to peacetime production of such consumer goods.

But for the rebuilding and expansion of her industries Russia looks to the United States for equipment.

Soviet representatives already are in this country with authority to negotiate for technical men and the equipment necessary to rebuild the great Donbas coal mines according to the most modern American methods.

It is important to remember that Russia's whole iron and steel industry, its non-ferrous mining and processing, some of its chemical production, much of its coke roasting and gas recovery, practically its entire automobile and tractor industry, and the largest of its hydroelectric plants, are based on American machinery and processes.

It is known among manufacturers that Russia recently has asked for bids on shipbuilding equipment, construction and roadbuilding machinery, alloy steels, textile machines, plastics, and a long list of rail, air, and water transport supplies.

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The Soviet Union, however, has more than a rehabilitation job on its drawing boards.

The first Five-Year Plan, which, as we all remember, was completed ahead of time in 1932, was devoted almost exclusively to heavy industry. Russia set out to build for itself the machines and the factories which, in later years, could turn out, at home, modern equipment for a vast range of light industries.

Stalin, when he inaugurated the second of his famous Five-Year Plans, promised that before it was completed Soviet factories would begin to turn out a flow of con-

sumer goods—ready-made dresses, canned foods, soap, cosmetics, shoes, kitchenware, automobiles, telephones, and modern houses.

But, by 1935, Moscow realized that Russia could not afford to enjoy such luxuries in the face of growing political tension in Europe. So, when the third Five-Year Plan was launched, there was no fanfare. Russians continued to wear their old clothes, to eat whatever simple food was available, and began grimly to build the industries which ultimately produced enough tanks, planes, and guns to turn the tide of battle at Stalingrad.

It is characteristic of Moscow that even before the last battles with the Nazis are over, Russia is planning to pick up its Five-Year Plans where the war had interrupted them.

Invitations to participate in a permanent exhibition in Moscow already have been mailed to American manufacturers. Soviet officials want their public to see samples of our new machine tools, aluminum and alloy products, oil-drilling machinery, bulldozers, and prefabricated kitchen equipment. Russia already is projecting specific plans to resume the job (1) of making the country an industrial giant comparable to the United States, and (2) of making life more pleasant for a long-suffering people.

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What is the measure of this postwar market in the Soviet Union?

Some estimates place the total quantity of goods which Russia might take from the United States during the first two or three years after the war as high as $5,000,000,000 a year. Then, as Russian industry is restored, imports from the United States might taper off perhaps to $2,000,000,000 a year.

Actually, these estimates are far too optimistic, unless the United States is prepared (1) to help Russia pay by buying vast quantities of Soviet raw materials, and (2) to provide large credits to handle the purchases during the first few years of rehabilitation.

The relations of American exporters with Russia during the period covered by the three Five-Year Plans have been eminently satisfactory. Moscow has met all of its obligations punctually; fifteen years of experience have reduced contract forms to the point where they cause a minimum of misunderstanding between the Russian representatives and the American producers; individual American companies with extensive prewar experience in handling Soviet business already are offering large credits on initial postwar orders though these may yet be replaced by large government credits at lower interest rates.

But the volume of trade with Russia after the war hinges upon Moscow's ability to pay. Never before the war did the United States buy more than $30,000,000 of goods a year from Russia. As late as 1938, Soviet exports to this country amounted to as little as $23,500,000, far less than enough to pay even the service charges on the credits which would have to be extended in connection with exports of several billion dollars a year. Only South Africa produces more new gold each year than the Soviet Union. But the United States does not want gold; more of it would only complicate the problem of controlling prices here.

If the United States, however, is to achieve, after the war, the high level of national income which is necessary (1) to keep our expanded factories in operation, and (2) to service the national debt, it might absorb from $90,000,000 to $100,000,000 a year of the kind of goods bought from Russia before the war—furs, timber, manganese, chromium, and handicrafts. But unless this volume of purchases from Russia can be boosted by another $50,000,000 annually, credits of the size necessary to fill immediate Russian needs could not be serviced without large supplemental importations of undesirable gold.

The nub of the situation is that Russia offers an extraordinary potential market particularly for our heavy industries which have grown so enormously during the war. But if this sales outlet is to materialize, then the United States must find a way to import from Russia (or from Russia's debtors if any) from ten to twenty times as much as we did before the war. Instead of merely going after the export business, American businessmen must explore with the Russians the possibility of buying bigger supplies of Soviet products.

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But more than the Russian market itself hinges upon sound cooperative action by the world's two leading military-industrial nations.

If trade between them is held to a minimum and if relations are strained, the flow of trade all over the world will be adversely affected.

Europe, long this country's biggest export outlet, certainly will never take the bold steps necessary to reconstitute its economy on a peacetime basis if Russia and the United States drift into a race for military supremacy.

The Balkan states, which may be industrialized by Moscow in order to reduce their dependence on Germany, and the Arab world with its huge need for transportation, irrigation, and sanitation, will not dare accept American credits or make big contracts with American engineers if Moscow frowns on the deals.

And refusal of Russia and the United States to work cooperatively to maintain the peace would kill, in their present embryonic stage, all dreams of a vast industrialization program for China.

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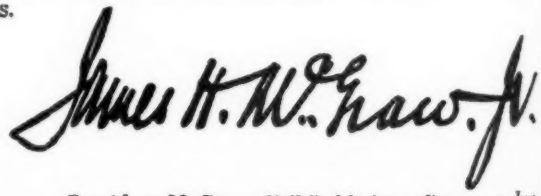
The opportunity to make a major change in the trade map of the world and at the same time to achieve a sharp rise in our own standard of living is before us.

It demands of American business leaders the kind of boldness and imagination that their predecessors displayed when they pioneered this country's unknown West.

It demands realistic action by men who know that the solution to this country's *real* foreign trade problem under today's conditions lies in boosting *imports* not exports alone . . . men who are not afraid of being paid for what they sell.

It calls for leaders who will approach Moscow and other major customers at once with constructive plans that would parallel in scope those on which this country is waging war . . . leaders who will make it clear at the outset that this bid for cooperative action emphatically demands that each nation shall have complete freedom to determine its internal political and economic organization without interference from the other.

It is *this* caliber of leadership upon which our future hinges.



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THIS IS THE 29TH OF A SERIES

More Makeup Means More Blowdown, BUT HOW MUCH?

Simple charts that can be set up for any given plant conditions tell at a glance how quality of raw water and permissible solids in drum water affect the feedheating cycle

By W PACK, *Chemical Engineer*
Iowa Electric Light and Power Co

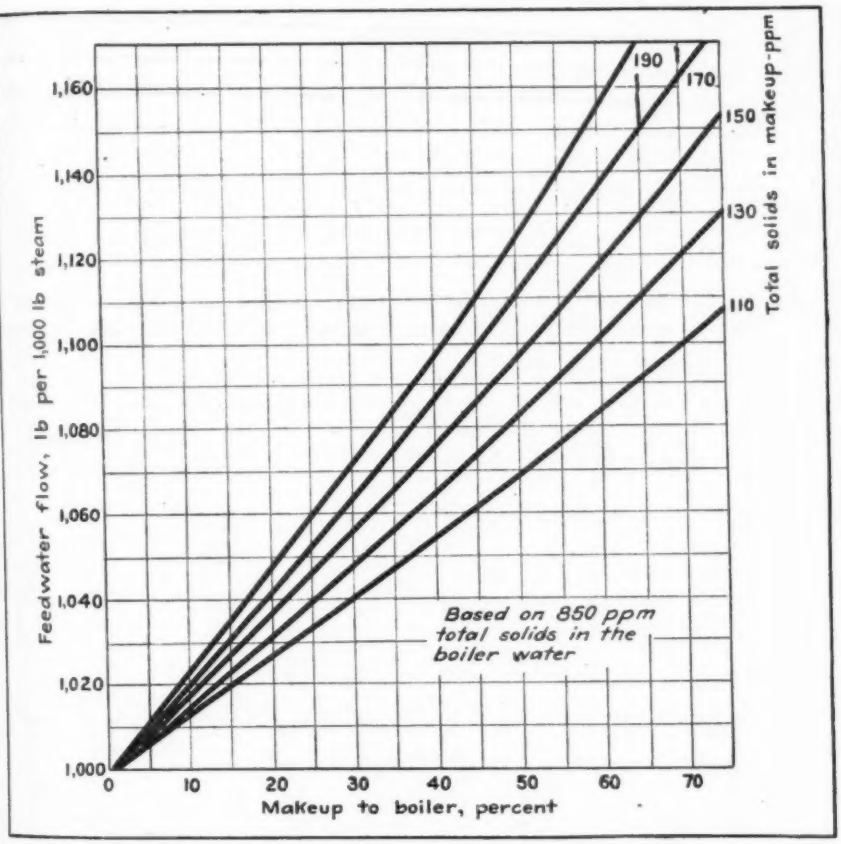

Fig. 1—Chart for feedwater flow to boiler per 1000 lb steam for 850 ppm total solids allowed in boiler-drum water with varying percent and quality makeup

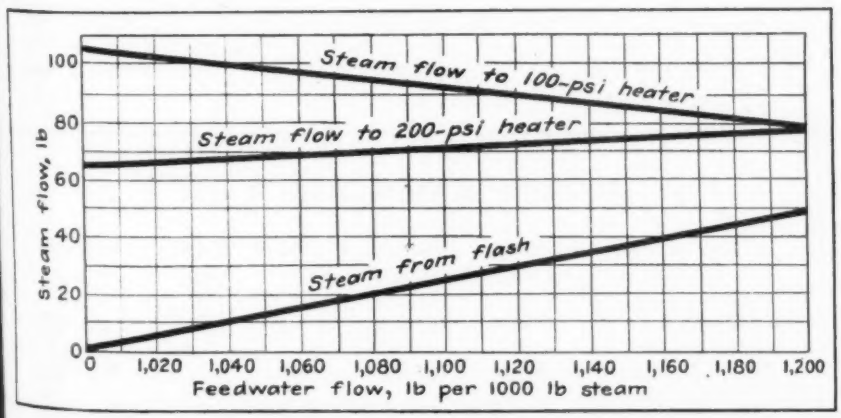

Fig. 2—Steam flow to flash heater, 100-psi heater and 200-psi heater, using the feedwater flow that is determined from Fig. 1, in lb per 1000 lb of steam

▶ To KEEP BOILER-WATER solids concentration at or below some specified limit, amount of blowdown has to be adjusted to some percentage of steam flow. For any given set of conditions, the amount of blowdown depends on steam flow, permissible solids concentration in the drum, total amount of makeup and solids content of makeup.

The interrelation of these values becomes somewhat of a vicious circle, that is, the more blowdown the greater will be the amount of required makeup and the added makeup in turn calls for more blowdown. For a given set of conditions, however, the variables can all be set down in charts so that the operator can conveniently and quickly check flow quantities.

Figure Flow

First step, Fig. 1, is to calculate and plot total feedwater flow to boiler for the established limits of total solids in boiler water, here 850 ppm. Curves should be calculated for the normal range of makeup quantity and for makeup-water solids content corresponding to the local supply.

Arithmetic is relatively simple. For example, to calculate one point on the curve for 110 ppm solids in makeup, Fig. 1, at 30% makeup and assuming an allowable limit of 850 ppm solids in the boiler water:

$$\text{Feedwater} = 1000 + \frac{1000\text{x}0.30\text{x}110}{850 - (0.30\text{x}110)}$$
$$= 1040 \text{ lb per } 1000 \text{ lb, approx}$$

Where appreciable amounts of blowdown are required by high makeup, considerable low-pressure steam can be obtained by flashing and recovering heat in a feedwater heater or heat exchanger (See Data Sheet No. 147, page 138.). For the turbine and heater arrangement of Fig. 4, blowdown is flashed at 65 psi gage, and about 25% of heat loss to blowdown is recovered together with a small amount of condensate. Flashed steam reduces the

amount of bleed steam to the 100-psi heater and slightly increases that to the 200-psi heater as indicated in Fig. 2. Values are plotted against feedwater flow obtained from Fig. 1.

Inspection of these curves indicates that low makeup (and consequent low blowdown) yields little steam for feedheating but as makeup percentage increases amount of flashed steam becomes greater. Heat recovery shows up as reduced bleed from the 100-psi stage despite increased feedwater flow.

For the conditions of Fig. 4, the amount of flash steam approximates 25% of the blowdown quantity. For any other set of pressure conditions, this ratio can be obtained from page 138. Calculation of steam flow to stage heaters can be done by usual methods of computing heat balance (POWER, March, 1943, p 174) starting with steam flow to highest pressure heater where the demand depends only on feedwater flow through the heater and stage pressure, both of which are known for a given set of operating conditions.

Heat demand at the flash heater of Fig. 4 depends on amount of drips from higher-pressure heaters as well as flash pressure so that an estimate of the drip quantities must be made on a trial-and-error basis. Since the variation due to drips is small, only one or two approximations are usually sufficient to establish conditions at the flash heater.

Deaerator Flow

At the deaerating heater the steam demand is complicated by several factors. Steam flow varies with amount and heat content of drips from upper heaters, amount and heat content of condensate returns from other sources, and the amount and heat content of the makeup water. Fig. 1 and 2 help in calculating deaerator steam by means of a chart such as Fig. 3.

If temperature of the mixed condensate returns and makeup can be calculated or measured for a given set of operating conditions, the amount of deaerator steam can be calculated for any two points and plotted as a straight line in Fig. 3. For the conditions of Fig. 4, a complete plot of heater steam flow is shown in Fig. 3 for any percent makeup (see Fig. 1) and any temperature of mixed returns.

By use of these curves total steam required for feedwater heating can be quickly approximated. Variations in steam requirement accompanying any change in chemical composition and amount of makeup water can be quickly taken into account.

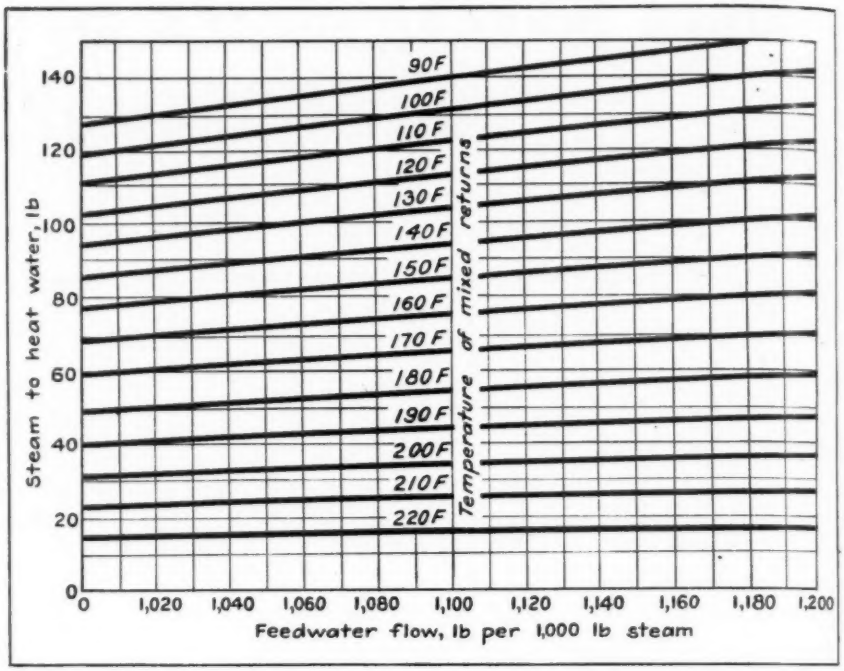

Fig. 3—Steam required at deaerating heater depends on feedwater flow per 1000 lb of steam and temperature of mixed makeup and condensate entering the heater

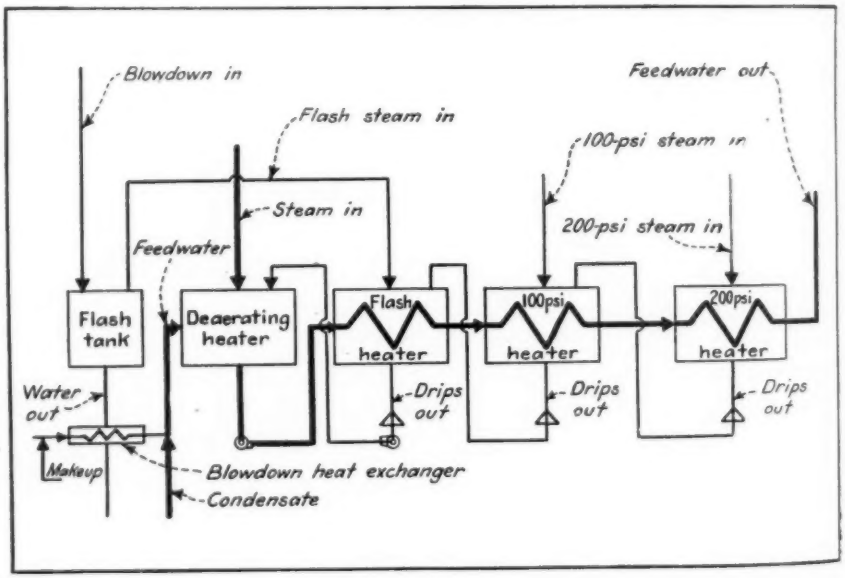

Fig. 4—Typical feedwater heating cycle on which curves of Fig. 1, 2 and 3 are based. Steam variations for feedheating can be calculated for change in makeup

Btu Content at Various Points in Cycle

Type of heater	*Steam*	*Water in*	*Water out*	*Drips in*	*Drips out*
Deaerating heater..	1160	Variable	198.1	281.9	None
Flash heater.....	1182	281.9	Variable	308.9	281.9
100-psi heater.....	1198.6	Variable	300.9	366	308.9
200-psi heater.....	1292.4	300.9	361	None	366
Blowdown heater...	None	Variable	Variable	281.9	Variable

Note: This table lists Btu content of water and steam at various points in cycle of Fig. 4 used in calculating Fig. 1, 2 and 3. Strictly speaking these values are not constant but variations are so slight for the purpose intended that they may be considered constant.

Jacks Eliminate Slugging When Hydroelectric Units Are Coupled

When bolting couplings of large vertical hydroelectrical units, maintenance dept men of this Canadian company found the going too tough. Result? They devised a hydraulic jack system that reduces hard work and time for the job almost to the vanishing point

BY RICHARD DEANE
Engineering Department
West Kootenay Power & Light Co

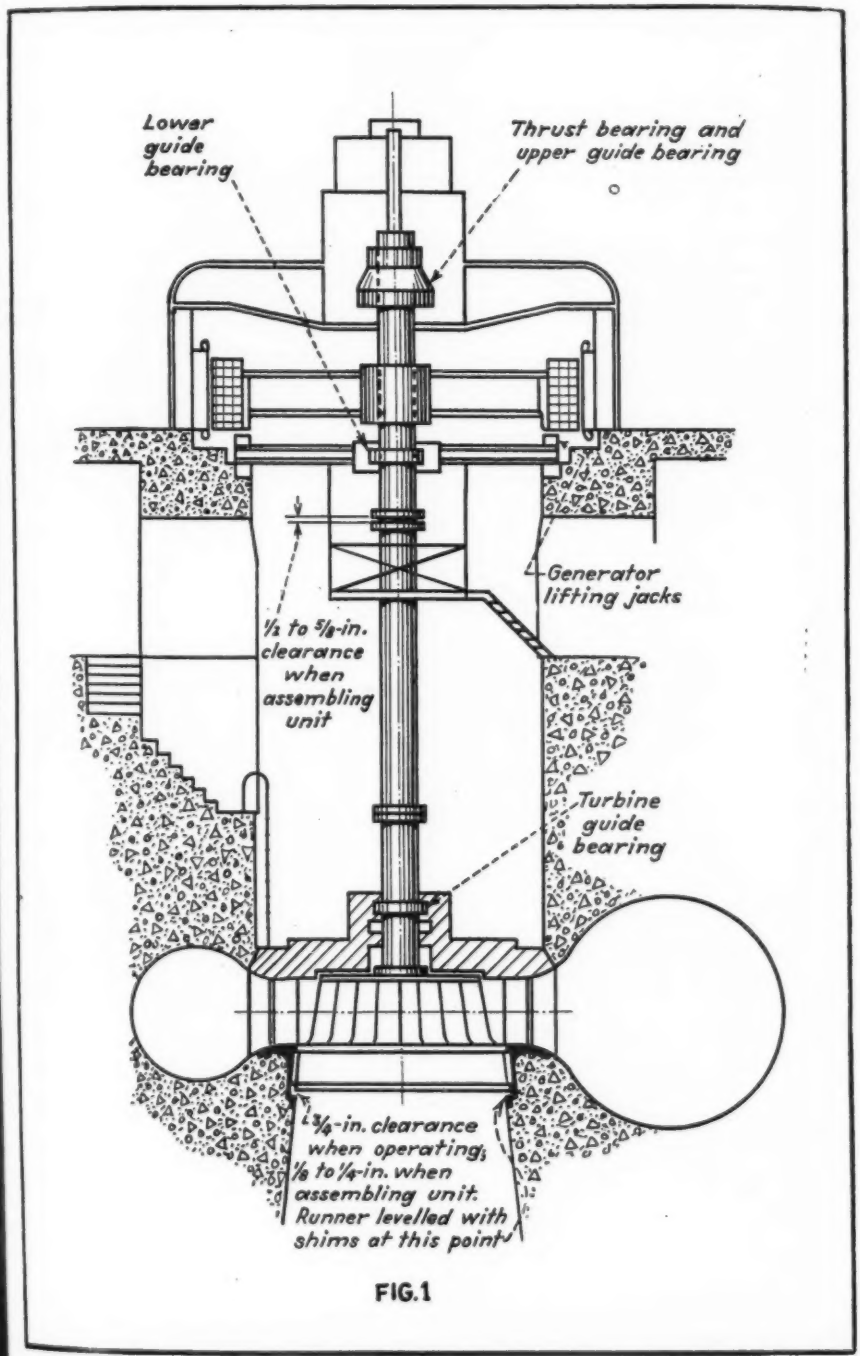
Lower guide bearing
Thrust bearing and upper guide bearing
Generator lifting jacks
½ to ⅝-in. clearance when assembling unit
Turbine guide bearing
¾-in. clearance when operating; ⅛ to ¼-in. when assembling unit. Runner levelled with shims at this point
FIG.1

Fig. 1—Diagram of vertical hydroelectrical unit showing where waterwheel is supported while generator is being aligned before installing the coupling bolts

► DISMANTLING LARGE vertical hydroelectric units for repair and afterward assembling them includes such operations as opening and making up the coupling between waterwheel and generator. Methods for handling such work have not been standardized so it may be of interest to take a look at the equipment we have developed for this coupling job and the way we use it.

When assembling the units the waterwheel is leveled with shims under its lower edge, as in Fig. 1. The runner is supported and leveled with shims until it is about ⅝ in. below its operating position. Then the generator rotor with its thrust and guide bearings is installed and its coupling-half lined up with that of the waterwheel. There is now about ⅝ in. clearance between coupling faces, ready to be bolted.

Former Practice

Our former procedure was to put in eight coupling bolts and bring the coupling faces together by gradually tightening the bolt nuts. This operation was equivalent to using the bolts as jacks to lift the waterwheel ⅝ in.

Each nut was tightened in succession a small fraction of a turn by slugging with a 14-lb hammer the handle of a heavy ring wrench. The men doing the slugging detested this extremely hard and time-consuming job. When dismantling a unit the waterwheel was lowered ⅝ in. in the same manner, which required about as much work and time as lifting.

To eliminate most hard work from this job and to reduce the time, we developed the jacking system, Fig. 2. The jacks can be used equally as well for lowering as for raising the waterwheel by providing the pump with a suitable

slow-opening pressure-release valve.

The idea for the jacking system originated with our shop men, particularly those who had been doing the heavy slugging. They not only developed the idea but scouted around and found the equipment they thought would do the job. Then they asked us in the engineering department to figure out weights, stresses, oil pressures and other factors. The equipment that was built has been used with a high degree of success.

We had available four 4-in. hydraulic jacks made from a piece of old shafting. These jacks did not have a pump valve or reservoir. We made a manifold from 1.5x1-in. key steel, which we drilled and tapped to accommodate ⅜-in. high-pressure hose, Fig. 2. This hose is the same as that used on high-pressure greasing equipment, and is good for at least 10,000 psi. We borrowed the blade-raising pump from our snowplow. A high-pressure pump was available on the generator-rotor lifting jacks, but we were afraid that without a long extension handle it might not produce sufficient pressure for the 4-in. jacks. Fig. 2 shows the hydraulic jacks placed to lift the waterwheel runner.

Jack Applications

We first used the jacks on a 25,000-hp 100-rpm unit, with a runner and shaft weighing 65 tons. This load, omitting friction, required 2600 psi on the 4-in. jacks. For safety, in case the hose, jacks or other parts started to leak, we put in four coupling bolts to act as guides and tightened their nuts as the jack lifted the runner. Evidently the four coupling bolts and spigot and the turbine-guide bearing developed considerable friction because a pressure of 3300 psi was needed to lift the runner. This is 15 tons in excess of 65 tons runner and shaft dead weight.

We recently lifted with the jacks a 35,000-hp 100-rpm runner and shaft weighing 85 tons, the equivalent of 3400 psi on the jacks. Using the ratio between dead weight and lifting pressure obtained on the 25,000-hp unit, we figured a lift pressure of 4300 psi for the larger machine. A gage to read this pressure not being available we do not know the exact pressure. It probably was less than 4300 psi, because the unit was being erected and the bolt holes had not been reamed. One bolt only made a snug fit in its hole; consequently there was very little extra bolt-friction load. A suitable pressure gage is a valuable accessory as it gives a clear indication of the jack and friction loads.

Work of lifting the runner with jacks was almost too easy to believe. One man on the pump could bring the coupling faces together in five minutes, but we took 20 minutes so that the guide-bolt nuts could follow the lifting closely. With the coupling faces brought tightly together four or eight bolts were tightened with wrenches, the jacking equipment removed and the remaining bolts put in and tightened. Final tightening of the bolts is still done by sledging the wrench handle. This, however, is a minor job compared to making five full turns of the nuts by this method to lift the waterwheel.

When making the hydraulic jack equipment we arranged the jack-supporting bolts, jack-bolt spacing in their plates, shape of the plates and length of bolts to fit all large units on our power system. When making the jack-supporting plates be sure to provide clearance for the wrench on the nuts adjacent to the plate ends. These nuts have to be tightened with a wrench while the jack lifts the runner. On some units better clearance between plates and nuts is obtained by placing the jacks above the coupling.

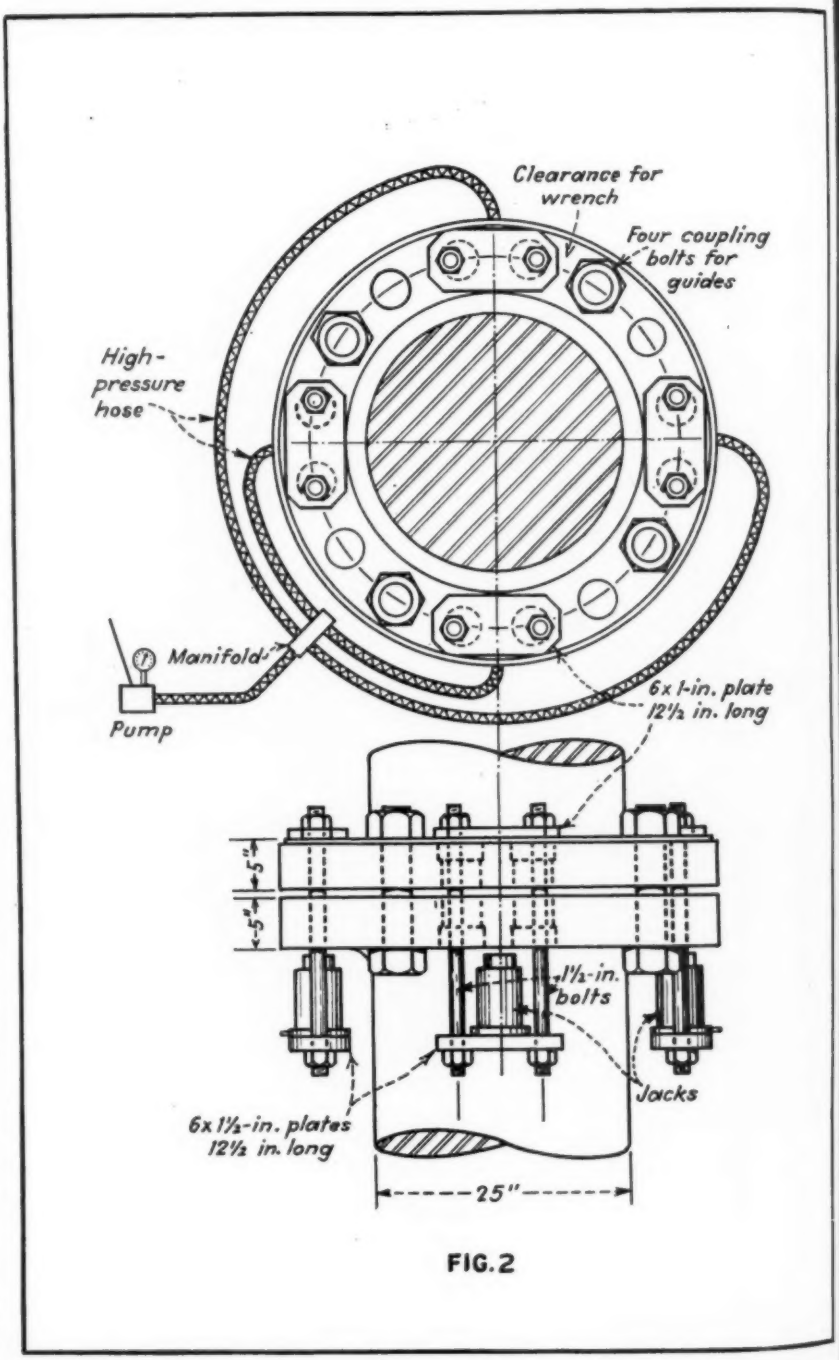

FIG. 2

Fig. 2—Arrangement of jacks and hydraulic system for lifting the waterwheel to make it easy to bolt the coupling half on its shaft to that on the generator

THE OPERATING ENGINEER

George Edwards *Advisory Editor*

PRACTICAL AIDS • MAINTENANCE HINTS • QUESTIONS → ANSWERS

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For Good Brush Performance Commutator Surface Must Be Right

Do you know the causes of streaking, etching and burning, pole-pitch marking, slot-pitch marking, flat spots, discoloration, or a raw surface on dc-machine commutators? W C Kalb, service engineer, National Carbon Co, gives the answers

NO MATTER HOW GOOD dc-machine brushes are or how well suited to a service, operation cannot be trouble free unless the machine's condition is right. Some potential sources of commutator-and-brush difficulties can be detected before trouble occurs. Others, less evident, first appear as commutator-surface imperfections, visible sparking, excessive heating or brush noise. A fault may give more than one indication or its first indication may cause others. For example, a fault causes sparking, which immediately produces a poor commutator surface and may lead to noisy operation. The latter can be permanently relieved only by eliminating the cause of the brushes' sparking.

Defects in commutator surface have many causes and varied forms. Mechanical faults, such as rough edges on commutator bars, uneven surface, eccentricity and high or low bars, call for resurfacing. Most manufacturers of commutator - conditioning equipment supply instructions for proper resurfacing of commutators. If bars are high or low, check commutator tightness and tighten loose V-ring or clamping bolts.

Properly undercutting commutator mica simplifies maintenance of good commutator surface: Accurately center rotary cutters across commutator length and maintain uniform cutting depth. After undercutting remove rough edges from segments and inspect commutator for thin mica fins at slot edges, Fig. 2. These fins, or feather-edge mica, are too common a source of sparking and poor commutator surface. They result from not properly centering cutting tool on slot; using a cutter too thin; not cutting V-slots deep enough—conditions exaggerated in Fig. 2 and 3. Center slot shows correct undercutting practice. Make an effective tool for removing mica fins by grinding a hook-shaped cutting edge at one end of a hacksaw blade and attaching a suitable handle. With such a tool you can in one operation chamfer the commutator-bar

Fig. 1—Undercutting commutator mica simplifies maintaining a good commutator surface, but this operation calls for care and precision when doing the job

edges and remove the mica fins, Fig. 4.

Mica flakes, copper or other foreign material embedded in brush faces may cause circumferential streaks on a commutator's surface. If mica or copper lodges in brush faces, inspect the commutator for mica fins and a cause of abrasion or poor commutation, espepecially high-current density in restricted portions of brush faces. The latter is often indicated by a dull or etched band parallel to brush width, at that portion of the brush face where high-current density occurs. In extreme cases brush faces may pit to an appreciable depth.

High-Current Density

Bands of high-current density result from a faulty commutation cycle, usually too rapid reversal of current or over- or under-commutation, a condition often corrected by slightly shifting the brushes or changing interpole-field strength. On interpole machines do not shift brushes far from neutral because of the compounding effect. Should a moderate brush shift not improve performance sufficiently, try adjusting the strength of the interpole field.

If streaking or copper deposits result from abrasive brushes try a less abrasive grade. Oil on a commutator's surface increases tendency for brush faces to accumulate copper and cause streaking. Low-average current density in brush faces sometimes causes streaking of commutator surface. This occurs oftenest with lampblack-base electrographitic brushes. Usually it is corrected by removing some brushes of each polarity, or by using a brush with better film-forming properties. Threading, that is, threadlike grooves in the commutator surface, usually represents an advanced stage of streaking, resulting from such causes.

Visible sparking, or a band of high-current density in the brush face producing interface sparking not noticeable at brush edges, usually causes bar etching or incipient burning of commutator bars. Adjusting brush position or interpole-field strength should correct this condition if imperfect compensation during commutation period causes it. The next article will discuss numerous other causes of sparking. Look first for feather-edge mica, a frequent cause of bar etching and burning, especially if burning appears at isolated sections along the commutator-bar edges.

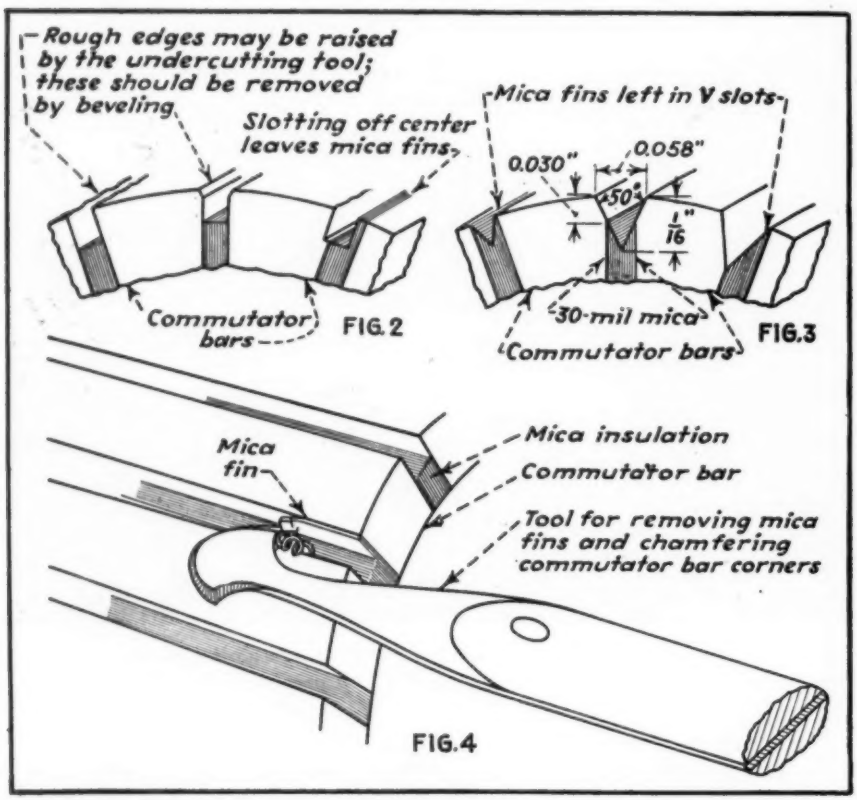


Fig. 2—U-shaped mica undercutter may leave rough edges on commutator bars or mica fins in the slots if you do not take care to remove them. Fig. 3—Mica fins will be left in V-shaped slots if cutter is off mica center or the slots are not cut deep enough. Fig. 4—After undercutting mica, fins can be removed and slots chamfered in one operation, as shown, by a tool made from a hacksaw

Burned bars, unless the result of flashover or external short circuit, represent an advanced stage of bar etching and can be corrected as described. If burning is severe, correct the cause and resurface the commutator. Loose or high-resistance connections between armature coils and commutator risers cause etched and burned bars. These connections, which may have considerable resistance when the armature rotates, may make firm contact when it is at rest. Thus, they are often hard to detect by usual tests for high-resistance coils with the armature at standstill. They can be located, however, by the bar burning immediately ahead of the one with poor connection.

In Fig. 5, a high-resistance connection to commutator segment 2 is indicated by a dotted line connecting it to the armature winding. Coil *A* carries full-load current of one armature path which, in the brush, should normally divide between segments 1 and 2. However, high-resistance connection of coil *B* to segment 2 causes most of coil *A* current to flow through the rapidly narrowing contact between segment 1 and the brush. This condition creates an extremely high-current density in the brush tip, which may cause sparking and bar marking. When segment 1 moves from under the brush, current concentrated in its trailing edge has to pass through coils *B* and *C* to reach a low-resistance commutator connection. Shift of current from segment 1 to 3 is retarded by inductance in these coils and some of the current jumps from the trailing edge of segment 1 to the brush, producing a spark, Fig. 6. If this condition is not corrected, the bar edge burns progressively and produces a bad flat spot on the commutator.

Commutator-Bar Marking

Bar marking, usually of less severity, can generally be found on the commutator one pole pitch from where the fault exists. It is not uncommon to find marking traces at one-pole-pitch intervals around commutator, caused by armature-circuit unbalance from faulty connection. Cross connections in the armature winding tend to minimize or eliminate this secondary marking.

Marking every second, third or fourth bar is usually associated with number of coils per slot. Fig. 7 represents a machine with three coils per armature slot, only one group of coils being shown. Commutator segment 2 is about to make contact with the brush, starting the commutation cycle of leading coil in the slot. Commutation of this coil is completed when segment 1 leaves

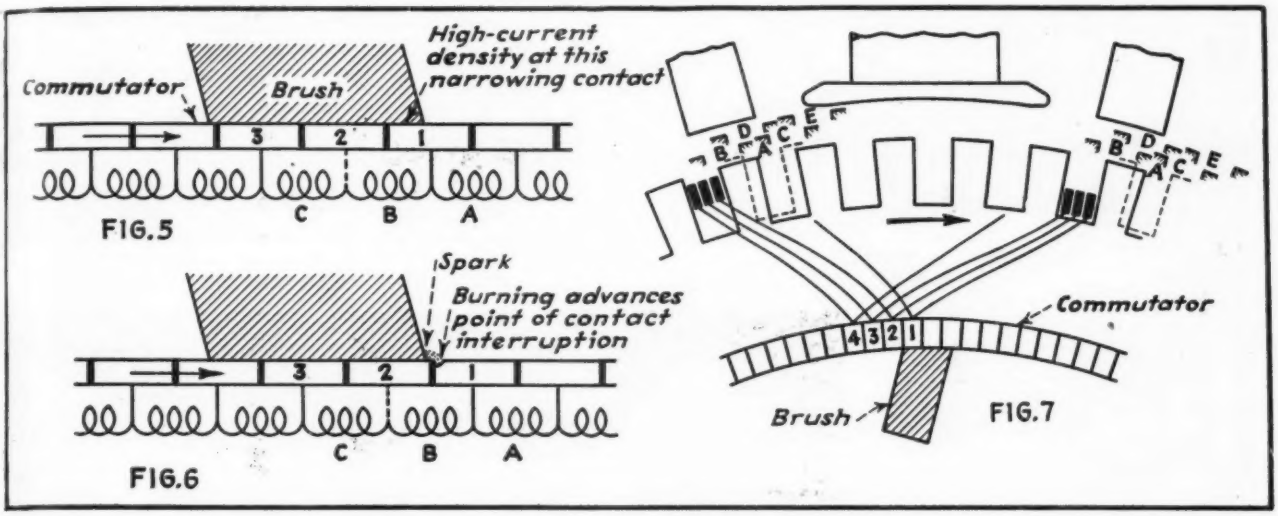


Fig. 5 and 6—A loose or high-resistance connection between the armature coils and commutator bars causes burning of the next bar ahead of the defective connection

Fig. 7—With more than one coil per armature-core slot, commutation of each coil occurs at a different position in the magnetic field under the polepieces

the brush, during which time the slots carrying this group of coils will have moved to *A*.

Commutation of the second coil does not begin until segment 3 reaches the brush and the slots are at *B;* it ends with slot at *C*. Commutation of the trailing coil in the slot occurs while the slots are moving from *D* to *E*. It is evident that field density is different for each of these coils during the commutation cycle. Even though the drawing exaggerates the difference in coil position, in practice, conditions may have a decided difference in commutating field for two or more coils in the same slot. When this occurs there is a tendency for marking to appear on the commutator at slot-pitch intervals.

If the magnetic-field commutating zone is wide enough, brushes may be set in a position to give acceptable commutation for all coils in the slot. Should marking continue after the best brush position is found, widen interpole-field influence by attaching poleface shoes or increasing interpole air gap. Interpoles are often backed up by nonmagnetic shims between polepieces and field frame. Removal of such shims to obtain required spread of interpole flux does not decrease interpole strength.

If magnetic shims are removed, however, or the polepiece machined off, interpole flux is reduced and should be restored to its original value. When the interpole winding is shunted, this can be done by removing the shunt or increasing its resistance. Otherwise, it may be necessary to increase number of turns on the interpoles. Changing to brushes with higher contact drop or slight polishing action also reduces tendency for commutator marking to develop on machines with more than one coil per slot.

Flat spots on commutators are sometimes caused by pounding of a loose bearing or unequal angular velocity on a generator driven by a reciprocating engine. As a rule they result from failure to correct some faulty condition. first indicated by burned bars. After removing the cause, true the commutator by turning or grinding. Sandpapering cleans the burned surface at a flat spot but does not give the commutator a true cylindrical surface and the spot is likely to develop again even though the original cause has been removed.

Commutator Discoloration

Commutator - surface discoloration may indicate excessive temperature, contaminated atmosphere or oil on the commutator. Discoloration from heat can usually be recognized as such. A later article will discuss sources and correction of excessive heating. Elimination of atmospheric contamination is often difficult. Many industries cannot entirely avoid such contamination by chemicals. Many, such as chloride, sulphur and acid fumes, cause commutator-surface discoloration and unsatisfactory performance. Brushes with a mild polishing action sometimes prevent operating difficulties but, in extreme cases, air conditioning is the only means to satisfactory operation.

Oil on a commutator tends to develop a dark, high-resistance glaze which may lead to burning of its surface. It also increases brush-face tendency to pick up copper. Oil sometimes creeps from bearings to the commutator surface and

(*Continued on page* 140)

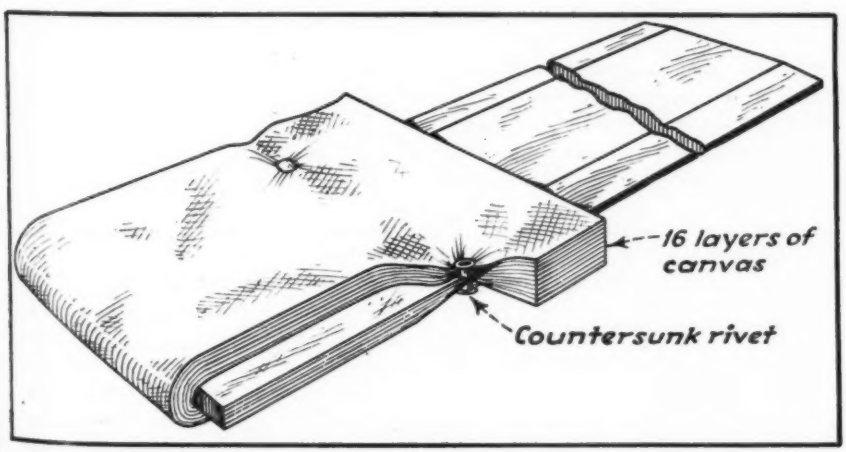
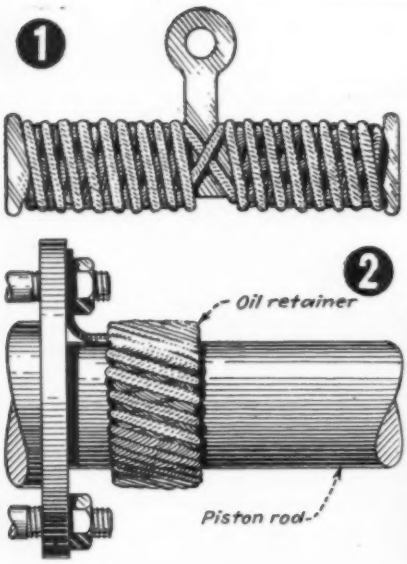


Fig. 8—To make a convenient and safe commutator-surface wiper, wrap several layers of hard-woven canvas or duck over the end of a strip of strong pliable wood and attach with hollow rivets in holes countersunk in the wooden handle

Plant-Tested Methods and Ideas for Power Men

PRACTICAL Aids



Oil Retainer Keeps Piston Rod Lubricated

WHERE IT IS NECESSARY to lubricate piston rods, the oil retainer shown in the figures has been used successfully. It is made from a piece of ⅛-in. strap iron, cut to the shape of Fig. 1, long enough to wrap around the rod. Bend the eye connection to fit a gland bolt and bend the strap to a U-shape around the rod. Then wind the strap with wicking and install as in Fig. 2. Finish bending the strap around the rod until the wicking maintains a slight pressure with it. Saturating the wicking occasionally with oil keeps the rod and packing well lubricated.

Great Neck, N. Y. S M ELONKA

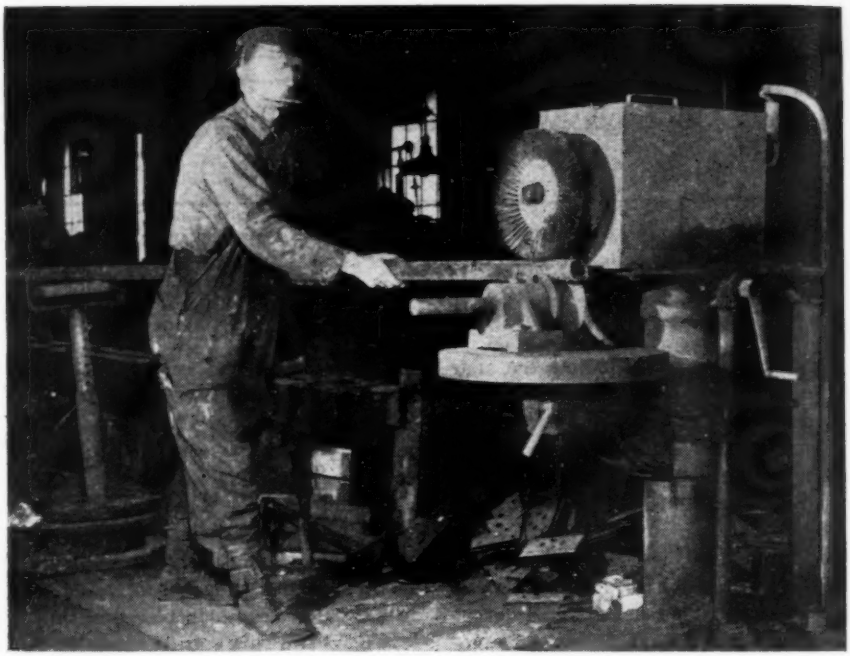
Keep Lineshaft Pulleys Running True

WOOD PULLEYS have many desirable features, but there is always the possibility of their wearing out of round because of shock or intermittent loads that cause belts to slip at a given position on the pulley. If this occurs, the belt goes through a cycle of stretch and contraction, having double the frequency of the load change. The belt contracts as it comes on the low side of the pulley, but is immediately stretched by the shock load. After the load stretches the belt it contracts, only to be stretched again as it runs on the high side of the out-of-round pulley.

This effect could be greatly magnified if the belt ran on two out-of-round pulleys, with their high and low sides in step. When a belt acts as though it had gone crazy, don't overlook the possibility of the pulleys being out of round. This is just as true of steel or other pulleys as of wood, but from other causes. Steel pulley may be bored off center, bored too large for the shaft and thrown off center by the key or setscrews, improperly fitted sleeve in hub, or other causes.

We make a practice of checking our wood pulleys every six months. If any are more than ⅛ in. out of round, they are removed at the first opportunity and trued in a lathe. We have four sizes of arbors that correspond to the four sizes of shafting on which we use wood pulleys. With these arbors it is easy to center the pulley in the lathe. After truing the pulleys we give them a coat of orange shellac. When it dries, we sandpaper it and apply another coat to complete the job.

Boston, Mass. B R STEWART



BRUSHING WHEELS RECLAIM OLD PIPE

ONE OF THE OLDEST and simplest power-brushing operations, that of metal cleaning by wire brushing wheels, has been applied to reclaiming old, rusty, discarded pipe. Typical of such installations is that of the Builders Structural Steel Co, Cleveland, Ohio, where pipe in various sizes and lengths is power-brushed to a practically good-as-new finish for many kinds of industrial reuse.

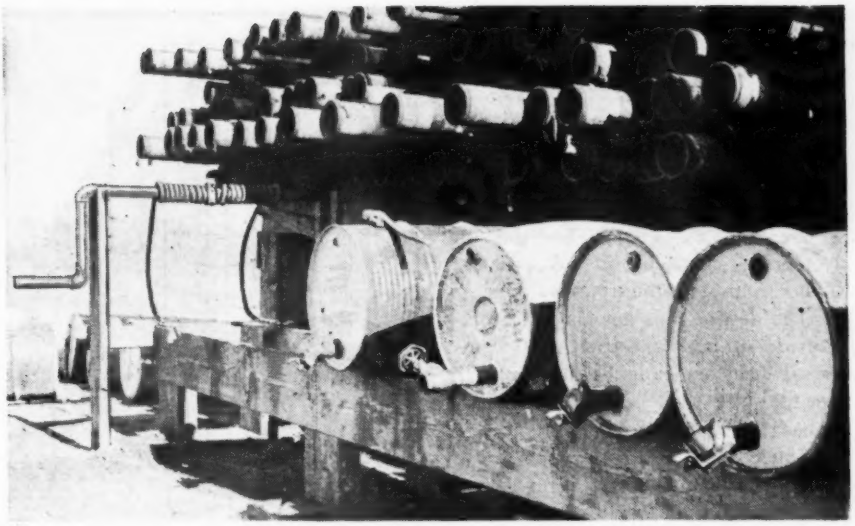
Depending on size of pipe cleaned, combinations of two, three, four or more wire-brushing wheels with disk center are mounted on a spindle powered by an electric motor. The wire brushes, of about No. 33 wire, revolve at 1800 rpm. Pipe is inserted between the brush and a roller mounted on the bed of the unit, as in the photo. The operator moves the pipe back and forth about 10 to 12 in. at a time under the revolving brushes, rotating the work slowly to clean all sides.

The roller fixture, equipped with a size roller to fit pipe diameter being brushed, is adjusted by turning a hand crank on the side of the fixture. Thus, pressure can be applied to thoroughly remove all rust and scale deposits.

Cleveland, O. G O ROWLAND
Osborn Manufacturing Co

to Operation

Windlass Handles Lubricating-Oil Drums



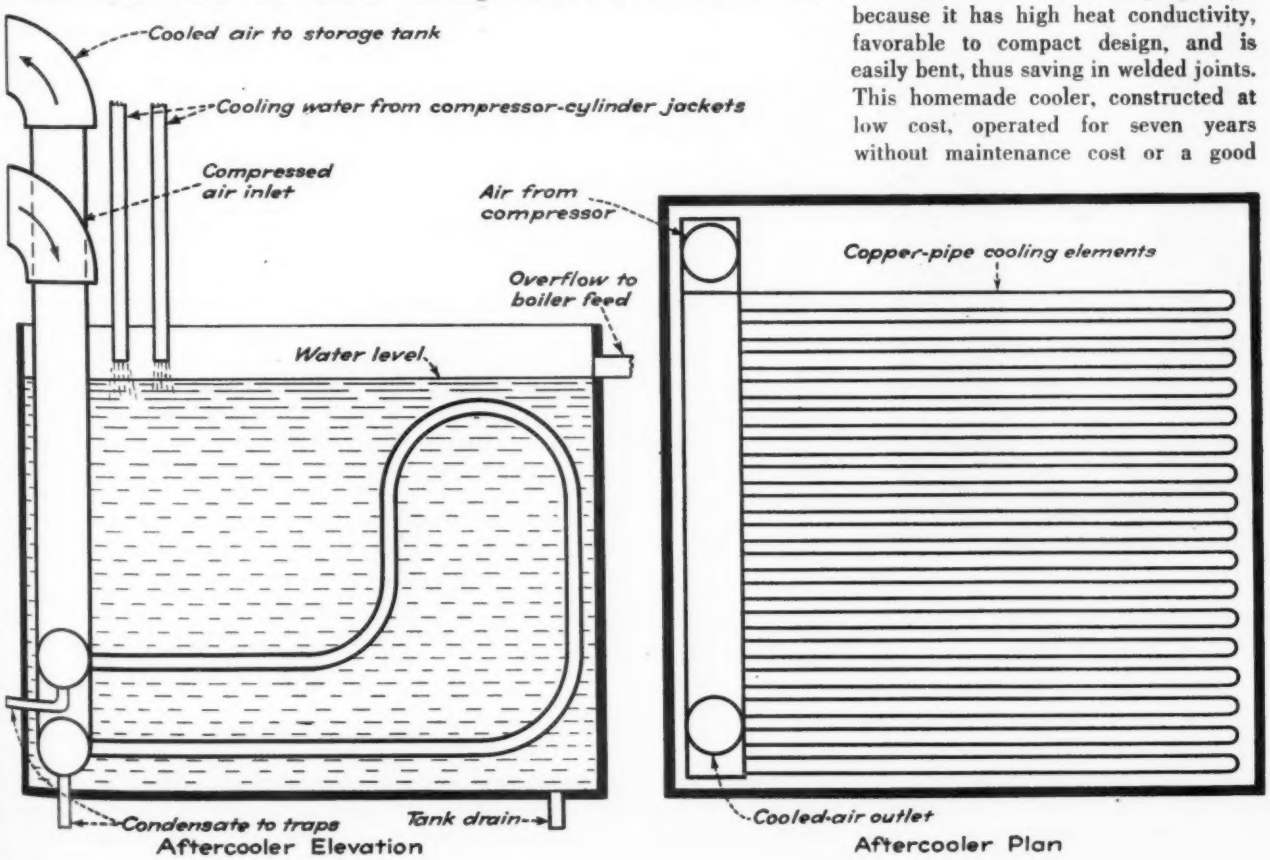
USUALLY, placing heavy lubricating-oil drums on a service rack is a two-or-more-man job, plus a pair of skids. One company made this a one-man job by using a simple windlass. At one end of the drum rack, two upright standards were installed to support a horizontal 5-ft length of 2-in. pipe with a crank at one end, as in the photo. The pipe was placed high enough so that an oil drum could roll between it and the rack.

To do the hoisting the two ends of a 16-ft rope were fastened to the rack skids and its middle to the pipe, so that turning the latter winds the rope around it. To lift an oil drum on the rack, the two rope strands are laid on the ground and an oil drum rolled and centered in the rope loops. Turning the crank lifts the drum to the rack where it rolls to, and is secured in, its proper position.

Pomona, Calif. G M WILSON

SIMPLE AFTERCOOLER FOR DRY COMPRESSED AIR

WE NEEDED an aftercooler for about 300 cfm of compressed air used in air brushes but could not purchase a unit of suitable dimensions. After two or three false starts the master mechanic solved the problem as in the diagrams. This cooler was installed in a plate-steel tank, 40 in. square by 32 in. high, fitted with suitable drains for cooling water and condensate. He made the cooler headers of two pieces of 3-in. galvanized pipe and the cooling coils from ¾-in. copper pipe brazed into the headers. Copper pipe was selected for the cooling elements because it has high heat conductivity, favorable to compact design, and is easily bent, thus saving in welded joints. This homemade cooler, constructed at low cost, operated for seven years without maintenance cost or a good

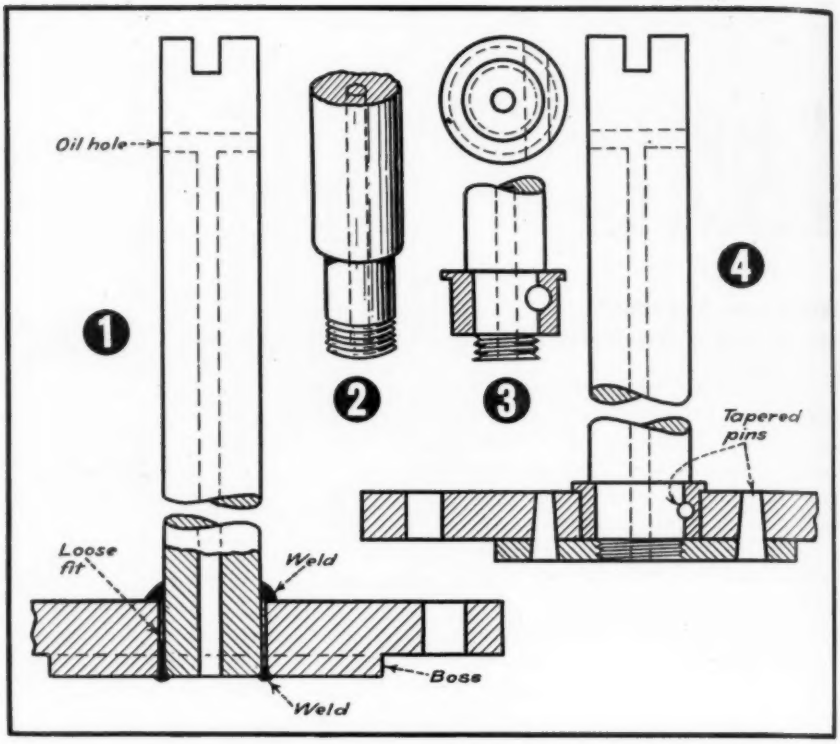


cleaning. Cooling water from the air compressors discharged into the after-cooler tank from where the overflow pipe led to the boiler-feedwater system. This water did two cooling jobs before serving as boiler feedwater.

Using well water for cooling we experienced no trouble in getting clean dry air from the cooler, nor did we have serious corrosion of tank or coils, which accounts for the trouble-free service. The design does not make as complete use of tank space as most commercial heat exchangers, but in our case the lost tank space is justified because the coils are simple to fabricate and easy to clean, if required.

In the design of such a cooler keep the air flow through it low so that the air has comparatively long exposure to the cooling water. To do this make the headers large and use plenty of small cooling pipes to get as much cooling surface as possible. Total cross-section of the cooling pipes should not be less than that of one header and preferably more.

Cincinnati, O. H B McDERMID

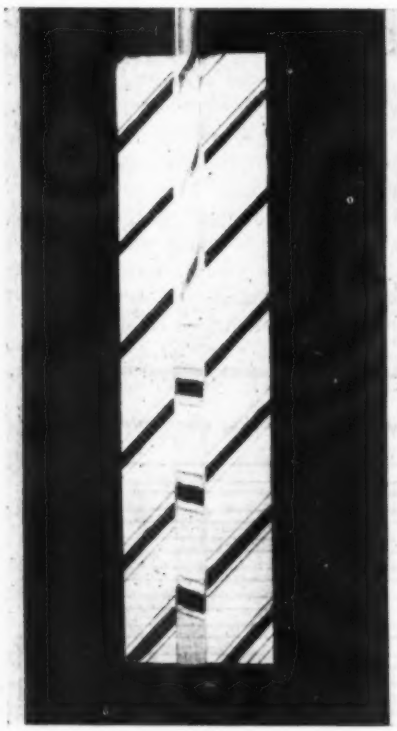


REPAIRS DIESEL GOVERNOR SHAFT FAILURE

ON ONE OF OUR DIESELS driving 500-kw generators, the governor drive shaft broke loose from its flange. The shaft where it went into the flange apparently was too loose a fit and had been prick punched to make it fit, after which it was welded to the top and bottom of the flange, as in Fig. 1.

We did not have a welding equipment, therefore had to make a repair with limited machine-shop facilities. We turned a slight shoulder on the shaft, Fig. 2, just enough to give a smooth-finished surface and turned a fine thread on its end for a nut. We next made a press-fit sleeve and pressed it on the shaft against the shoulder and secured it in place with a tapered pin, Fig. 3. The flange was next bored out for a press fit on the bushing, its ¼-in. boss machined off, and a nut made to substitute for it and hold the shaft in the flange. After pressing the flange on the shaft and tightening the nut, the latter was pinned to the flange with two tapered pins, locked in place by peening. Fig. 4 shows the completed job. The engine is now in service with every evidence that the repair is permanent.

Great Neck, N. Y. S M ELONKA



Card Back of Gage Glass Shows Liquid Level

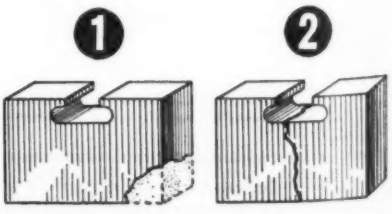
IN CLEAR LIQUIDS such as gasoline or water, it is sometimes difficult to see the liquid top surface in the gage glass. This may cause overflow or low liquid level with disastrous results. One company inserted a striped card behind the water glass on a tank, as in the photo. Bending of the stripes on the card where the light passes through the liquid shows the liquid level. As indicated in the photo the bands behind the liquid show at an angle 90 deg from those on the card.

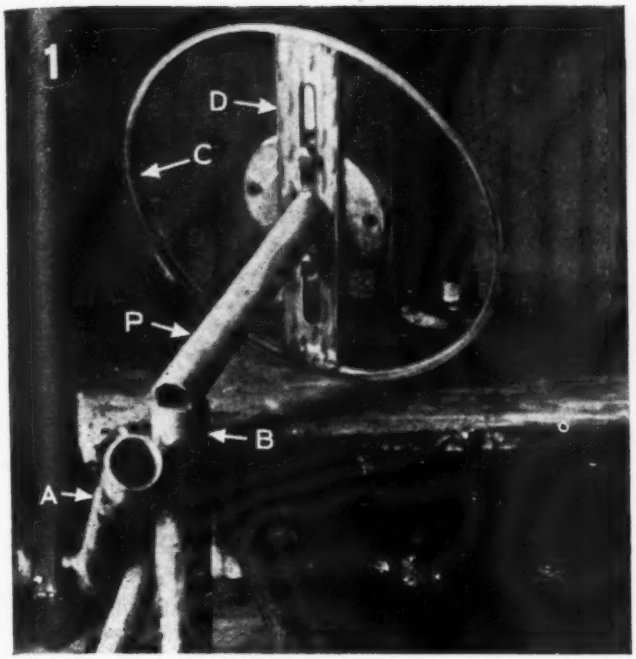
Norton, Kan. HARRY A HESS

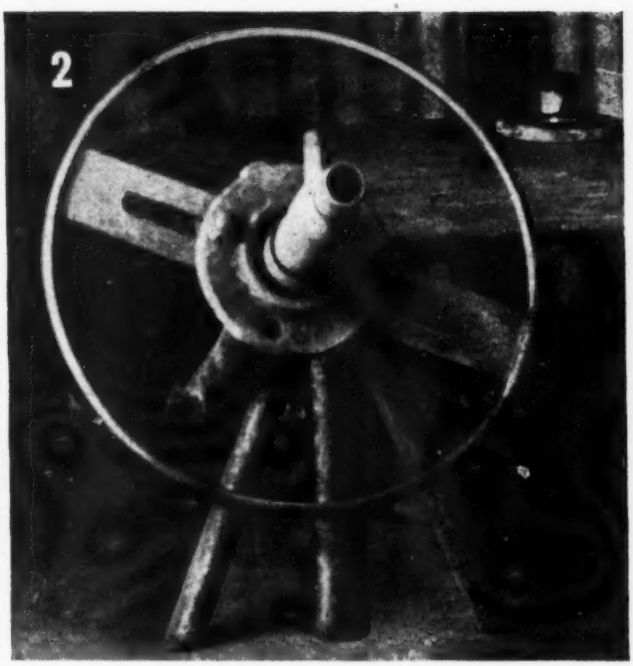
High-Temperature Cement Repairs Arch Tile

TO KEEP THE OLD PLANT GOING during these times of many restrictions, operating engineers do many things they normally would not do. In the good old days when boiler-furnace arch tile broke we discarded them. Now we fix them with high-temperature cement or plastic firebrick. If a tile cracks in two, Fig. 2, we coat each half of the break with high-temperature cement and firmly press the halves together until the cement dries. Spalled tile are repaired with plastic firebrick, Fig. 1. These examples indicate a few of the many ways we have used these materials.

Aurora, Colo. E J DUFF







MAKE JIG FOR WELDING PIPE FITTINGS

BADLY NEEDED PIPE FITTINGS could not be readily obtained under wartime restrictions so a plant welder built the jig in the photos. The steel-top table, where he welded small parts, was supported on two horses of welded pipe. He welded two short lengths of 2-in. pipe, *A* and *B*, one vertical and the other at a 45-deg angle to one horse, as in Fig. 1. These pipes form the support for the movable part of the welding jig.

The movable part consists of pipe standard *P* to which is welded cross member *D*. A slot in *D* permits bolting different sizes of pipe flanges to it to hold the fittings being welded. Circular band *C*, welded to the ends of *D*, completes the jig.

When using the jig, the welder places it in the vertical holder, assembles and tack welds the work. Then the jig with the work is put in the 45-deg support where the job is completed, Fig. 2.

Santa Monica, Calif. J C ALBRIGHT

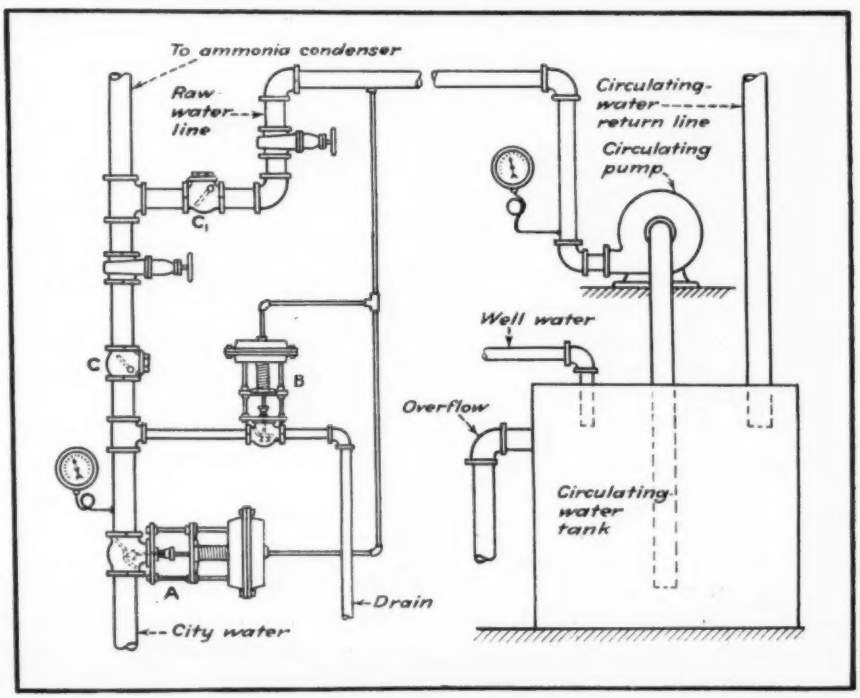
Ties City Water Line To Condenser Supply

OUR AMMONIA COMPRESSOR does not have a high-pressure cutout to trip its motor off the line if excessive head pressure develops. Consequently, we had trouble with high head pressure when the circulating-pump motor stopped or lost its suction. To insure water to the condenser we connected into the city water supply, as in the diagram. To do this we used two diaphragm valves.

During normal operation the circulating pump supplies water to the condenser at a pressure higher than that in the city main, and check valve *C* remains closed. Pump pressure on diaphragm of valve *B* holds it open to drain the line between check valve *C* and diaphragm valve *A*. This prevents leakage through check valve *C* contaminating the city water.

Pump pressure holds diaphragm valve *A* closed. If the pump fails a spring opens valve *A* and *B* closes. City-water pressure then opens check valve *C* and closes C_1 and this water flows through the condenser to the circulating-water tank, and to waste when the tank fills. When the pump starts again its pressure opens drain valve *B*, closes valves *A* and *C*, and discharges through valve C_1 to the condenser.

Ottawa, Ont. JOSEPH BONGIORNO



READER'S PROBLEMS

Exercise your engineering wits by submitting answers to these questions fresh from the plant. Suitable material will be paid for; answers accompanied by sketches or photographs command additional pay

Questions from Our Readers

1—Can We Stop These Pipe Failures?

WATER SUPPLY for our laundry comes from an 8-in. main at 100 to 150 psi through a 2-in. branch fitted with a pressure-reducing valve. This valve reduces supply pressure to 55 psi for direct feed to washing machines. On washing machine side of the reducing valve a 4x48-in. air chamber connects to the water line as a protection against violent surges in the line.

Amount of water drawn to fill the washing machines varies from 50 to 200 gal and when full mark is reached the regulating valve closes suddenly.

We have considerable trouble with ¾-in. lead bends, connected to the 8-in. line about 300 ft from the laundry, that burst open, presumably from excessive pressure. Is this trouble caused by the quick-closing pressure-regulating valve? What can we do to eliminate the trouble?—*GFJ*

2—Will This Pump Do the Job?

COOLING WATER at 15 psi flows through a double-pipe 2-section cooler and out a 2-in. discharge line to the sewer. We would like to save this water by elevating it to a storage tank 40 ft high with a centrifugal pump having a 2-in suction. The pump is direct connected to a 5-hp 1720-rpm motor.

We have no other data on the pump and would like to know how we can determine whether it will do the job. Interference to flow through the cooler cannot be tolerated, but increased velocity will be beneficial. Can we operate this setup automatically?—*PCJ*

Answers to September Questions

Will This Hookup Be Satisfactory?

(This is Question 1 from the September issue, with best answers from readers.)

We are preparing to install a 10x16-in. single-cylinder double-acting ammonia compressor which carries intake and discharge manifolds connected to both ends of the cylinder. The installation engineer is going to remove the manifolds and pipe up one end of the machine for single-acting operation.

I cannot understand why he should want to make a single-acting machine out of a double-acting one. Won't this increase our power cost considerably?

I suggested if it must operate single-acting that the manifold be left in place and fitted with shutoff valves so that we can make either end the working end. Naturally, this arrangement must include suitable relief valves to prevent high internal pressure in the end not connected to the system. The erector says this is too dangerous to consider. Will POWER readers help me with this problem?—TMM

Plan for Future Needs

IT IS EVIDENT that TMM's machine has twice the capacity needed. His suggestion to leave the other manifold on is sound if, after the war, he plans to add more refrigeration. If so, install correct size piping between compressor and receiver, also plan to install enough condensers to carry the full compressor load.

The contractor's suggested setup is also satisfactory. Power costs would be directly proportional to amount of refrigeration done.

If TMM does not plan to expand and can see no other need for the extra refrigeration, I suggest that purchasing a smaller machine is the best solution because the larger machine requires more room, and larger piping and power cables.

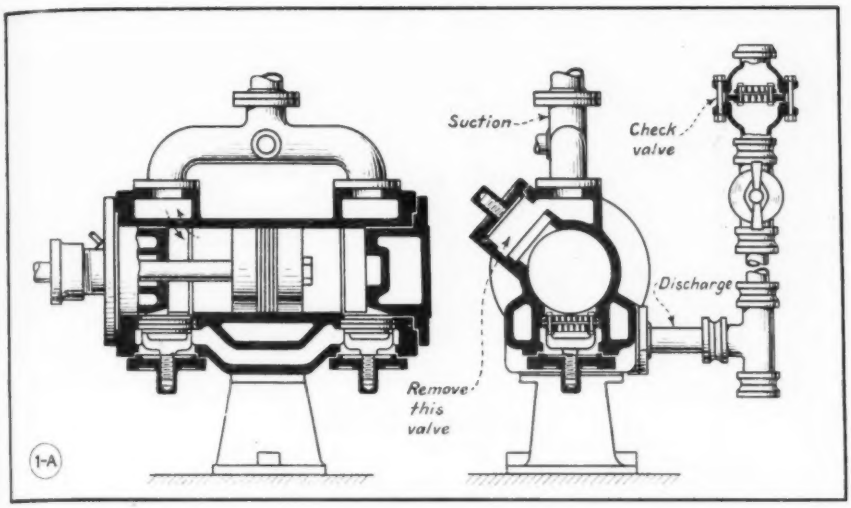
Brooklyn, N. Y. A J WENIG

Will Disturb Driving Power

I CANNOT UNDERSTAND why the erector wants to convert a double-acting ammonia compressor to single acting except to meet some peculiar plant requirements. Whether such a conversion can be made depends to a large extent on type and design of discharge and suction manifolds.

Some compressors have manifolds of rather intricate design that cannot be adapted for service other than that originally intended. Others have manifolds made up of parts that might permit certain desired changes to be made without much difficulty. Alterations to the original design must assure safe operation.

In connection with single-acting operation you must prevent: (1) excessive pressure in the cylinder dead end (2) compression against the return stroke. Placing extra valves in the manifolds to shut off the unused end does not take care of these requirements unless you relieve compression in that end of the cylinder and take care of gas leakage past the piston. If the compressor is operated single acting, make the head end of the cylinder the working end to relieve the piston rod packing of high pressure.



Safe operation could be obtained by removing the suction valves from the dead end and blanking off a section of the discharge manifold on the same end, sketch 1-B. Then pressure in the unused end of the cylinder could not exceed suction pressure and the piston could not build up compression on its return stroke.

When operating as the erector proposes, power cost would increase in proportion to efficiency loss as the compressor could not be expected to deliver a full 50% of its rated capacity. It is doubtful whether such operation would prove satisfactory for regular service. The unbalanced condition arising from operating the compressor as a single-acting machine may disturb the driving power; if it is motor driven this effect may cause disturbance to the line voltage on nearby circuits supplied from the same source.

Jersey City, N. J. I S CHAMBERLAIN

Remove Suction Valves

COMPRESSOR SUCTION VALVES are designed to permit gas flow into the cylinder and prevent escape of this gas back through the suction line on the compression stroke. Discharge valves function to permit discharge of compressed gas to the system, and prevent return of this gas to the cylinder on the suction stroke. Opening and closing the valves is effected by pressure differential across them.

It is readily evident, sketch 1-A, that the only thing necessary to effect single-acting operation is to remove certain valves so that the gas merely surges in and out of the compressor cylinder. Here it would only be necessary to remove the suction valves from one end of the machine, which can be done by completely removing the valve or providing the valve with lifters. Both accomplish the same purpose. It would be preferable to unload the crank end of the compressor, since this prevents the stuffing boxes being subjected to high pressure.

Numerous tests have been conducted to determine the effect of clearance on horsepower consumption; results indicate that power remains practically constant with increased clearance or, in other words, reduced volumetric efficiency. There is, naturally, a slight increase in horsepower required for the reduced capacity at the same compression ratio, but this is readily understandable if we keep in mind that the frictional horsepower of the machine is practically constant at constant speed. We can, therefore, see that the mechanical efficiency is necessarily less.

Power cost will be more than that for a machine specifically designed to carry the load now required. For the reduced capacity now obviously required in TMM's plant, and which necessitates using the machine as a single-acting instead of double-acting unit, present operation as a single-acting unit is most expedient. Increased power consumption over a unit specifically designed for the service will not become important until continuous operation is desired.

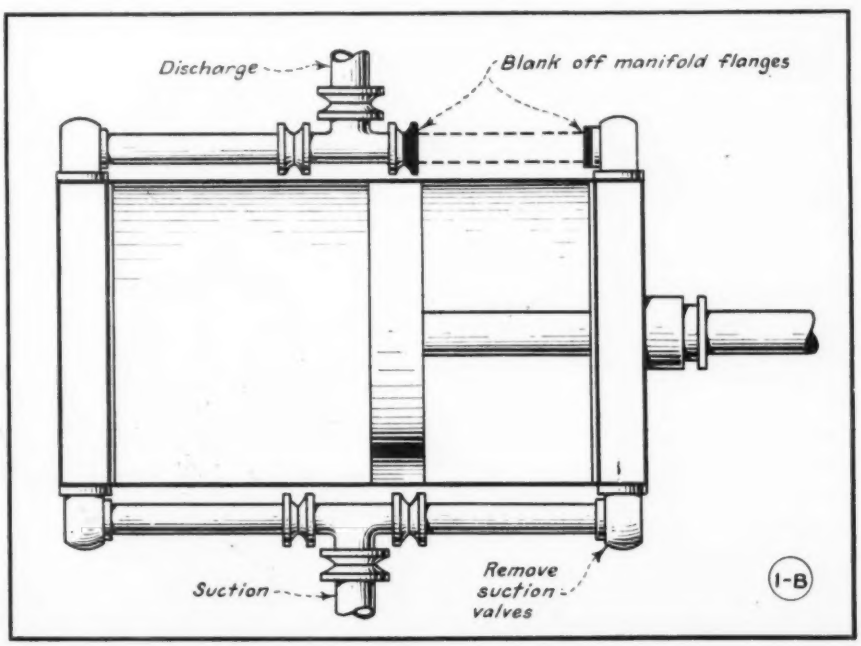
It is not advisable to change the suction manifold although this procedure would be preferable to using shutoff and relief valves. With the previously outlined procedure no change in suction manifolding is necessary. The danger attached to using shutoff and relief valves is the possibility of relief valve failure causing serious overpressures or overload on the motor.

TMM can equip this machine with suction valve unloaders on both crank and head end of cylinder, which permits operation at half load or no load. Compressors can also be equipped with a valve lifter that lifts the inlet valve assembly from its seat, allowing free passage of gas into and out of the cylinder, completely unloading that end.

West Orange, N. J. R C MCDONALD

Compressor More Efficient at Full Load

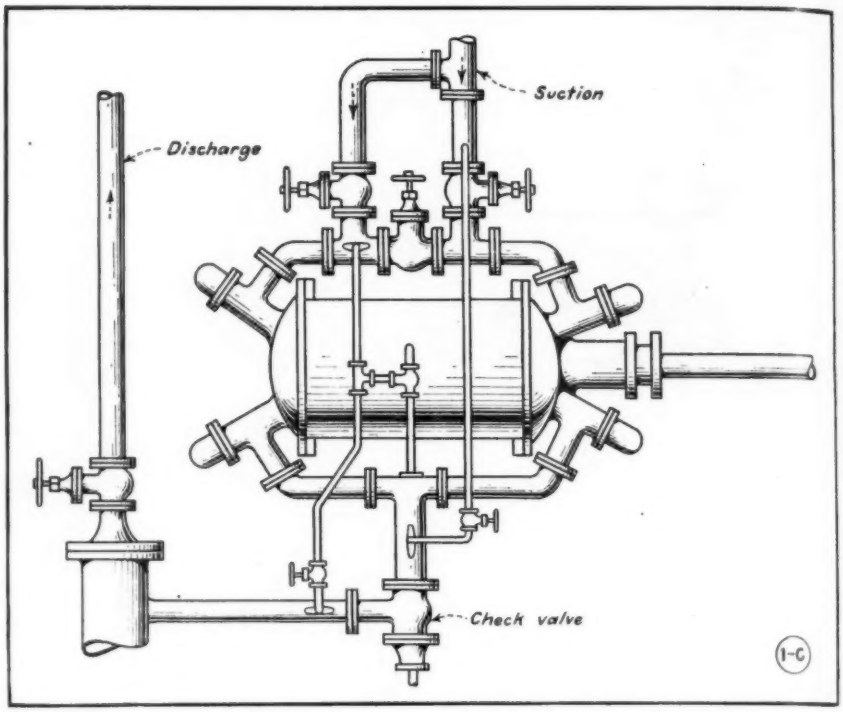
THIS COMPRESSOR is probably designed for two suction pressures with split manifold, and I suggest TMM pipe as in sketch 1-C. Use one suction valve



for each end of cylinder for single-acting operation and a center valve to isolate any side. Also pipe both suction valves to one common suction header. Both ends of cylinder should discharge into one header through a combined stop and check valve. A discharge and relief valve on each end of discharge manifold is dangerous.

If one end fails, compressor can be run single acting. This is not advisable if machine is belt-driven unless compressor has sufficient flywheel effect or runs fast enough to prevent irregular speed. Probably the erector figures machine is too large for the work required and this is the reason for single-acting operation. It would be better to operate double-acting and run the machine fewer hours per day. Power consumption depends upon the amount of work done, and machine and drive would be more efficient at full capacity than at half.

Ottawa, Can. JOSEPH BONGIORNO



Needs Help on Selecting Valves

(This is Question 2 from the September issue, with best answers from readers.)

We need a regulating valve to regulate steam flow to a closed water heater and another to maintain an accurate liquid level in a process tank. The steam-regulating valve will operate at frequent on-and-off periods. On the other hand, the liquid level valve must operate at different points within its range to regulate liquid input according to varying amount of outflow.

I have been studying flow-travel curves of V-port, throttle-plug and ratio-plug regulating valves without coming to any conclusion as to which of the three is best suited to my purpose. Will POWER readers give me information on the special merits of these valves for different flow requirements?—BVN

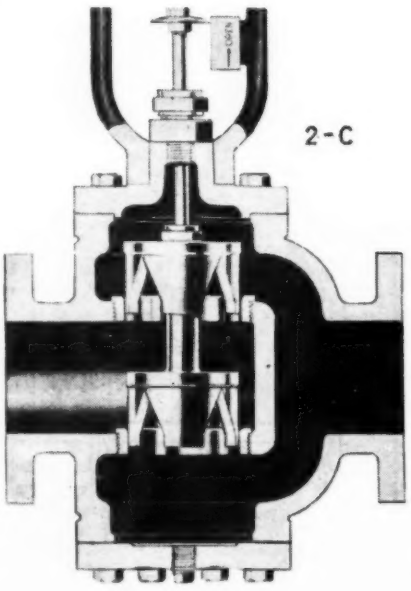
V-Port Compared With Throttle-Plug Valve

I SUGGEST that BVN consider either the V-port or throttle-plug valve, both of which have basically the same characteristic when flow is compared to valve travel.

The ratio-plug valve should not be used, since it has a percentage-flow characteristic. By this I mean that for every increment of lift an equal percentage of flow increase is obtained within the stroke and capacity of the valve. This characteristic is advantageous where highly varying pressure drop across the valve is encountered in the control system—line friction loss or process loss. This is generally not encountered in the application for steam-pressure-reducing valve work to a closed feedwater heater, or for liquid level control.

Use either the V-port valve, Fig. 2-C, or the top-and-bottom-guided throttle-plug construction for the services. They serve equally well.

Marshalltown, Iowa P A ELFERS



Suggests Bevel-Plug Valve

THE NAMES *ratio plug* and *throttle plug* are trade names of valve plugs, which are made by one manufacturer but which carry different names when made by others.

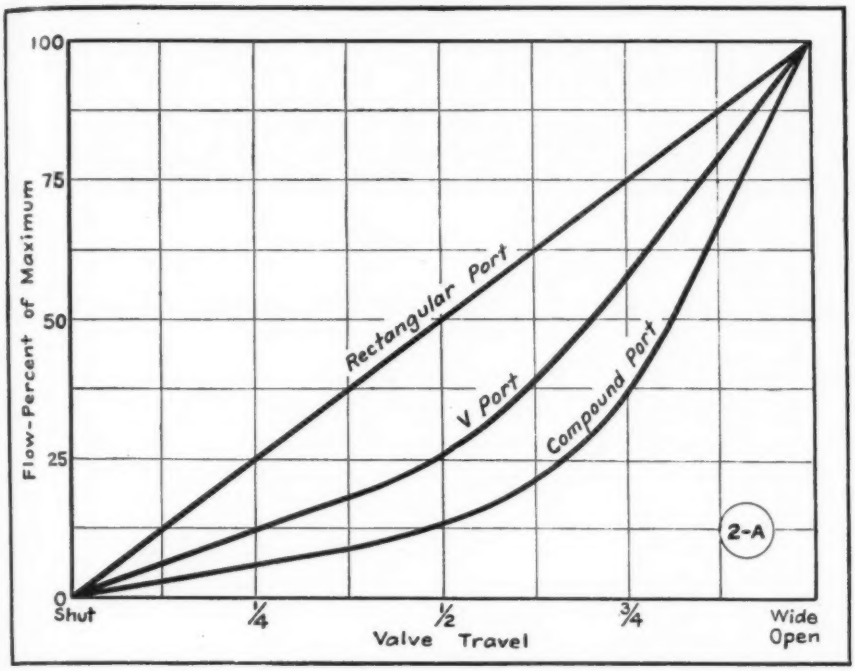
Ratio plug provides equal percentage increase in flow for equal amounts of valve lift. It has greater rangeability than the other plugs, but it could be V-type construction, as well.

Equal percentage plugs are preferred for widely varying flow rates requiring stable control at small and large flows. Small clearances between orifice and plug required to produce equal percentage flow characteristic, make it troublesome with viscous and abrasive fluids or widely fluctuating pressure. It has comparatively long travel and is, therefore, not suitable for self-operated regulators with small travel.

V-plug valves may have any flow characteristic from equal percentage to the quick opening, depending upon the V-shape—a characteristic that varies with manufacturers.

Assuming that the question refers to the V-plug with equal increments of flow for equal increments of lift, such valves are frequently used for average applications at moderate pressure drop. Their rangeability is less but construction is simpler and more serviceable.

Throttling-plug valves have decreased flow increments, as the plug moves toward full open position. Although



they have smaller rangeability, they may be preferred for their wearing qualities against viscous and abrasive fluids and extreme pressure drops.

From the brief statement of the problem, a self-operated regulator with single-seat bevel plug for tight closure during off periods would be adequate for the services. For the liquid level, a float-operated valve may be adequate or, perhaps, a diaphragm valve operated by a level controller may be preferable.

Bridgeport, Conn. N BELAEF

Consider These Four Points

DETERMINE CORRECT TYPE of port for regulating valve applications by considering: (1) variation in pressure drop across the valve from closed to open position (2) percentage of maximum flow at which the valve will normally operate (3) importance of sensitive control at the lower flow rates (4) whether tight shutoff is required. Curves in sketch 2-A show the theoretical flow characteristics of three typical valve-port shapes based on constant pressure drop.

The rectangular port provides uniform changes in flow rate per unit of valve travel. However, in actual service, pressure drop usually is not constant, but increases as the valve approaches closed position because of pipeline friction and other causes. Such would be the case with a trapped steam coil in the water heater. Higher pressure drop produces relatively large changes in flow rate per unit of valve travel near the closed position. Consequently, the rectangular port is more suitable when the valve normally operates in the upper half of its range, or where pressure drop is fairly constant.

The V-port provides smaller changes in flow per unit of valve travel in the initial part of its stroke. This inherent characteristic tends to counteract the flow effect of differential pressure changes. Thus it normally provides good control throughout its full travel. It is the most commonly used port in control valves.

Where differential pressure builds up rapidly with decreasing flow or where sensitive control is desired in the lower ranges, the characteristic as represented by the compound port would be advantageous. This produces even finer throttling effect during initial part of stroke.

To assure good performance, BVN should consider other factors that are often of greater importance than the ports. He should select a valve that meets the following specifications:

1. Valve port sizes should be designed for the required maximum capacity and existing pressure drop.
2. Valve should have relatively high lift.
3. Valve should be balanced under flow conditions. This does not mean simply a valve that has upper and lower seats of equal flow areas, for not all such valves are actually balanced when handling flow.
4. Valve should have low stuffing box friction.

Importance of points 1 and 2 to good control are obvious. Points 2 and 3 have great influence upon the valve's ready response to small changes in actuating force. For example, if a direct-operated float-controlled valve is installed in the process tank, small changes in level will produce relatively little force. This force should reposition the valve rather than be opposed by friction or unbalanced forces.

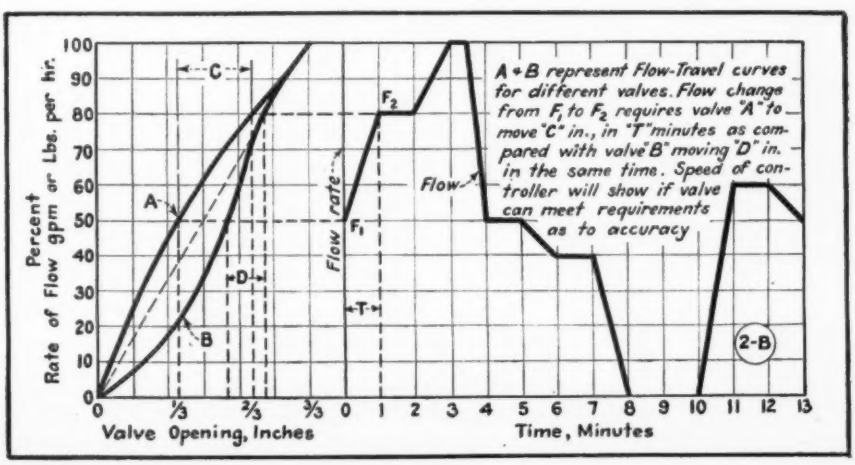
Erie, Pa. L D CARLYON

Draw Flow-Time Curve

DETERMINE ACTUAL FLOW RATES as accurately as possible and plot them against time for a period covering all service variations. Maximum flow based on minimum inlet pressure determines valve size, which should be kept as small as possible. Minimum flow determines type of valve seat. If drop-tight shutoff is required, a single-seated valve is necessary. Steam-regulating valves usually leak slightly and a safety valve or other protection is necessary on the downstream side.

When plotting the graph of flow against time, sketch 2-B, plot flow-

(*Continued on page* 146)



Q&A QUESTIONS & ANSWERS FOR POWER ENGINEERS

By ALEX HIGGINS

20—*Boiler Feedwater Heating and Treatment (Part II)*

Twentieth in a series that is running in every number of* POWER. *From long experience as a professional and practical engineer, Alex Higgins, of Calgary, Alberta, Canada, asks and answers questions regarding power equipment.

Q 1—What is an evaporator?

A—It is an apparatus for securing pure feedwater by distillation. A bent-tube evaporator, operating on much the same principle as a firetube boiler, but using steam instead of hot gas as the heating medium, is shown in Fig. 1. Steam enters at the top of the manifold, passes through the rows of bent tubes, returns to the bottom of the manifold and drains away as condensate. Water in contact with the outer surfaces of the tubes evaporates and passes out as vapor at the top of the shell, either to a closed condenser, like a closed feedwater heater, or to an open feedwater heater where it is condensed.

Distillation of the water in this way removes dissolved gas, but all solid impurities are left in the evaporator, which must be cleaned regularly to remove scale from the outside surface of the tubes. One method of scale removal is to crack it off quickly by varying the steam and water temperatures, causing the tubes to expand and contract. Sometimes a water softener is used ahead of the evaporator to prevent scale formation, in which case the impurities are deposited as a soft mud and can be removed by blowdown. Evaporators are commonly used in condensing power plants to purify the raw makeup water required for boiler feed. In most industrial plants the large percentage of makeup would make evaporators too large and costly.

Q 2—What is the cause and cure of "foaming" and "priming"?

A—Foaming is said to occur when the steam space in a boiler is partially filled with unbroken steam bubbles. Priming is the carrying over of liquid water from the boiler by the steam. Foaming is caused by impurities in the water preventing the free escape of steam as it rises to the surface, or by an oily scum on the surface of the water. This surface scum may be caused by oil, vegetable matter or sewage in the water. The remedies are treatment and filtration of the water to remove solid impurities, plus enough blowdown to avoid excessive concentration of salts.

An exceedingly dangerous operating condition, foaming indicates a pressing need for boiler cleaning, feedwater treatment, or both. It is practically impossible to tell the true water level in a badly foaming boiler, and so it may be damaged through low water.

Priming, carrying over of water slugs with the steam, may be caused by the same conditions that cause foaming, but it may occur with perfectly pure feedwater if the steam space is too small, if the boiler is forced away above its normal capacity, or if the water level is carried too high. Priming is highly dangerous because of the possibility of suddenly lowering the water level below the danger line, also because the water slugs carried over may do great damage to pipelines, valves, fittings, pump and engine cylinders.

To avoid priming and probable water-hammer damage through sudden opening of large steam valves, all main stop valves on boilers and steam lines, and throttle valves on engines, should be opened very slowly and water in the boiler should not be carried above its normal level. In plants with superheaters any solid water going to the superheater is there evaporated, so troublesome deposits are formed in the superheater. Solids carried over may damage steam turbines.

Q 3—What are the causes of corrosion, and how do you prevent it?

A—Corrosion is the wasting away of the metal surfaces of boiler parts. It may be external or internal. External corrosion is a rusting process caused by water leaks or drips on the outside surface of the boiler or at places hidden by insulation or brickwork. It may also occur in firetubes and flues from the action of sulphuric acid formed from moist soot and the sulphur dioxide in combustion gases. Internal corrosion is caused by acids, oxygen (from air) or other gases in the feedwater, or by electrolytic action.

Corrosion evenly distributed over the metal surface is called *uniform* corrosion; it may be in the form of little holes or pits, called *pitting*, or it may occur as the eating away of a narrow groove along the edge of a riveted joint, called *grooving*. The latter is induced by the

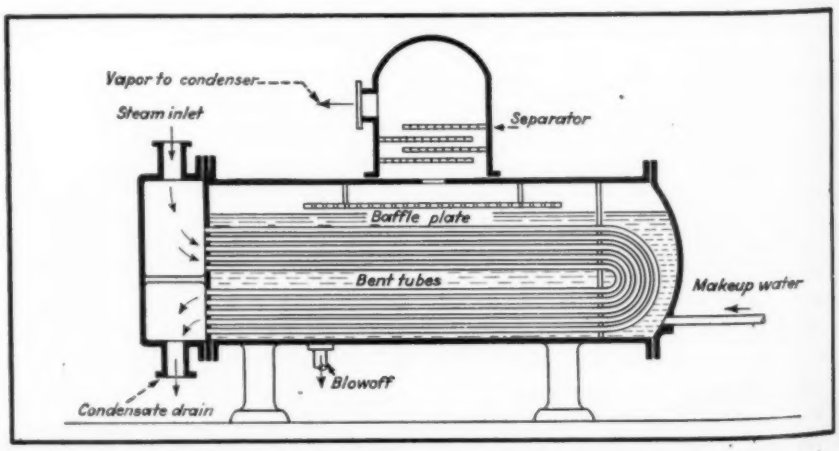


Fig. 1—Submerged-type bent-tube evaporator for distilling feedwater makeup

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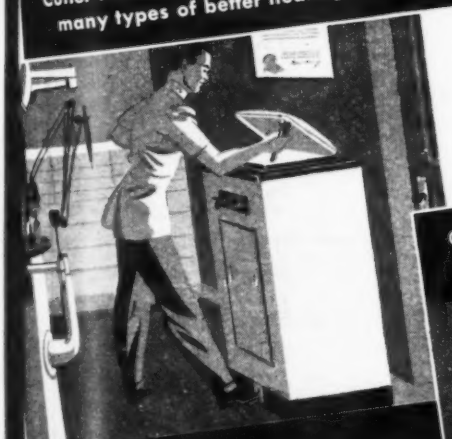

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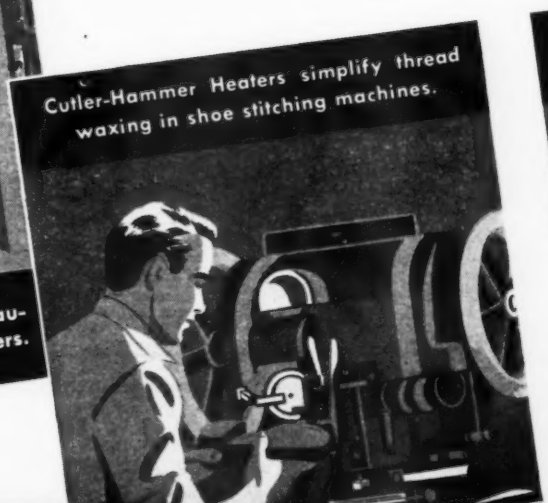
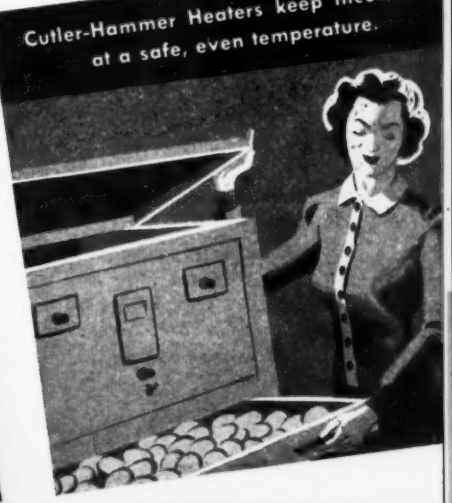


Cutler-Hammer Heaters keep incubators at a safe, even temperature.



Q&A FOR POWER ENGINEERS

(*Continued from page* 118)

slight bending action of the metal along the riveted joints as the boiler expands and contracts. This movement keeps a narrow strip of metal surface clean and free from scale, thus offering a clean surface for corrosive elements to attack.

External corrosion may be prevented by keeping external surfaces, also tubes and flues, clean and dry. Internal corrosion may be prevented by suitable water treatment and the removal of dissolved gases, particularly oxygen.

Q 4—What is caustic embrittlement and how do you prevent it?

A—So-called "caustic embrittlement" is a hardening and crystallizing process, sometimes called intercrystalline corrosion, which causes fine cracks in metal, particularly in riveted joints and around rivet holes. Its exact cause has not been fully determined, but it commonly occurs where feedwater contains a large amount of free bicarbonate of soda or has been treated with excessive amounts of soda ash, caustic soda or compounds containing these chemicals. This is one of the dangers of using a boiler compound without knowing its exact composition and the feedwater's impurities.

Sodium bicarbonate and sodium carbonate *hydrolyze* under heat and pressure into sodium hydroxide (caustic soda). This caustic soda tends to concentrate in the riveted joints where its contact with the steel is believed by some authorities to liberate free hydrogen gas, which penetrates and embrittles the steel.

Results of extensive tests in laboratories and in boilers under ordinary working conditions seem to indicate that embrittlement can be prevented if all alkalies that might yield sodium hydroxide are eliminated and if sodium phosphate is used to maintain the correct degree of alkalinity in the boiler. Tannin and lignin derivatives have proved to be effective inhibitors of embrittlement over a wide range of boiler pressures.

All-welded boilers offer no cracks for concentration of caustic soda, and hence should be free from embrittlement trouble. The same holds true of boilers with riveted joints if they are calked inside and not outside so that any parts that are not tightly calked can be checked by external signs of leakage through the joint.

Q 5—For what are "deconcentrators" and "continuous blowdown" systems used?

A—When there is high concentration of soluble or suspended solids in boiler feedwater some will undoubtedly precipitate as sludge and bake into scale on tubes and plates. This condition can and should be remedied by proper treatment and filtering to remove troublesome solids before the feedwater enters the boiler. Where further filtering is desirable, some of the boiler water can be removed continuously, passed through a deconcentrator, which is simply a pressure filter, and returned to the boiler.

Strong concentrations of soluble impurities, while they may not be scale forming, may cause foaming, priming and even corrosion. Blowing down the boilers at intervals will reduce this concentration. Fig. 2 shows the principle of continuous blowdown. It keeps concentration within reasonable limits and at the same time prevents loss of heat if the blowdown water is passed through a *heat exchanger* where its heat is given up to incoming feedwater. The heat exchanger is similar to a closed feedwater heater or a shell-and-tube condenser. Hot blowdown water passes through the tubes contained within the shell, and the cold water circulates around the outside of the tubes, or vice versa. Control valve placed between boiler and heat exchanger controls blowdown flow rate.

Q 6—What is meant by the pH value of boiler feedwater?

A—All water contains free hydrogen (H ions) and hydroxide (OH ions). H ions give acid reactions and OH ions give alkaline. In pure water that is neither acid nor alkaline these ions balance each other and the water is neutral. If the balance is disturbed so that H ions predominate the water will be acid; if OH ions are in excess, it will be alkaline.

In feedwater treatment it is important to know the degree of acidity or alkalinity, and the pH system of notation has been devised for this purpose. It is a simple number scale based on the hydrogen ion concentration. Number 7 on the pH scale is the neutral point. Below 7 acidity increases, the lower the number the greater the acidity. Above 7 alkalinity increases, the greater the number the greater the alkalinity.

Feedwater should be alkaline rather than acid to prevent corrosion, but too high a degree of alkalinity may induce caustic embrittlement. Correct pH value can be determined only by careful tests in each case.

A simple test for finding pH value can be made by adding a definite amount of a prepared dye, called an "indicator," to a measured sample of water, allowing it to stand for a few minutes, then matching the color of the mixture with a set of numbered standard color tubes. Chemical supply houses supply dye indicators and color standards.

Q 7—What dangers may arise from oil passing into the boiler with feedwater?

A—Oil will coat the heating surfaces and cause them to overheat, keeping the water from making direct contact with plates and tubes. Oil will also form a scum on the water's surface and prevent steam bubbles breaking away readily from the surface, thus causing foaming. Oil can be removed from the feedwater by proper filtration.

Q 8—Why is it desirable that air and other dissolved gases be removed from

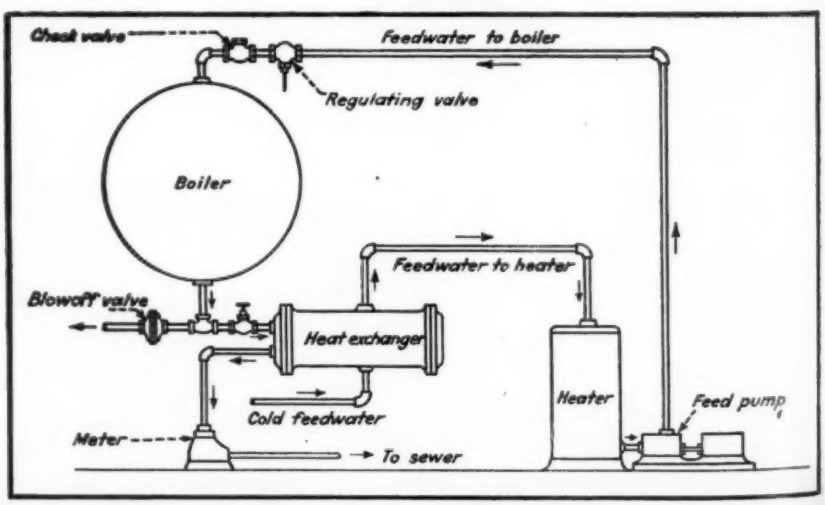


Fig. 2—Continuous blowdown arrangement with recovery of heat to feedwater

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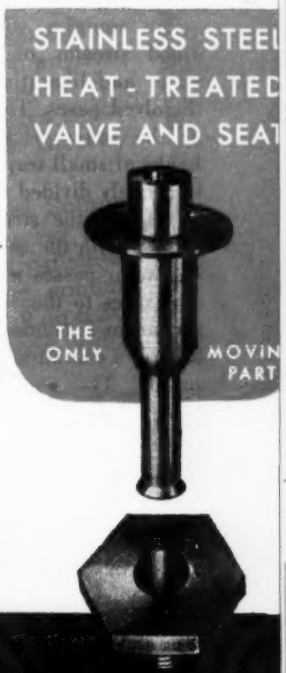

YARWAY IMPULSE STEAM TRAP

Q&A FOR POWER ENGINEERS

(Continued from page 120)

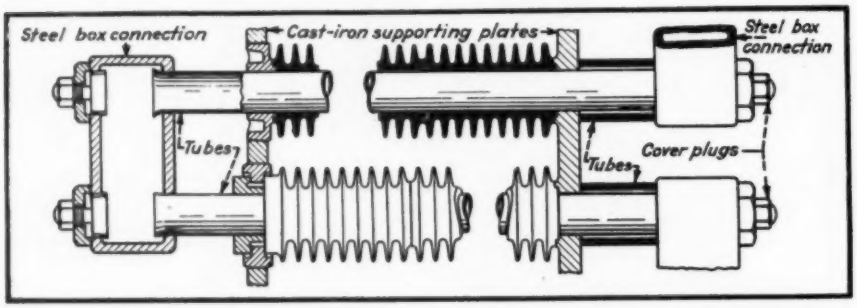

Fig. 4—Steel-tube economizer element with cast-iron fins extending surface

feedwater before it enters the boiler?

A—Some of these gases, particularly oxygen, have a very corrosive action on metal. Carbon dioxide may also produce corrosion, or combine with other impurities to produce scale.

Q 9—Sketch and describe an apparatus for removing air and other dissolved gases from boiler feedwater.

A—If the water is heated close to the boiling point in an open heater most of the dissolved gases can be separated out and vented to the atmosphere. For more complete oxygen removal, use a deaerator or deaerating heater.

An improved form of open heater which also acts as a very effective deaerator is shown in Fig. 3. Feedwater passes first through the tubes of a small vent condenser, then discharges into the upper part of the deaerator in the form of a great number of fine sprays. Entering steam mingles with these finely divided streams of water, heating the water and liberating the air and other dissolved gases. This process continues as the water trickles downward over banks of small trays, which still keep it in a finely divided state.

Most of the steam is condensed by contact with the water, but any remaining vapor passes with the separated air and gases to the vent condenser where the steam is condensed by contact with the tubes containing the incoming water supply. The condensed steam drains back to lower compartment of deaerator, and the air and gases are vented to the atmosphere if the deaerator is being operated at a pressure above atmospheric pressure. If the pressure in the deaerator is below atmospheric pressure a vacuum pump is used to draw off air and other gases from vent condenser.

Q 10—What is the special purpose of an economizer in a steam boiler plant?

A—An economizer is a device for using some of the flue-gas heat that would otherwise go to waste by pumping boiler feedwater through banks of tubes placed in the direct path of gas passing to the chimney. As the economizer is placed between feed pumps and boiler, water is under a little higher pressure than boiler pressure and can be heated to a much higher temperature than is possible when feedwater is heated at or near atmospheric pressure.

Cast-iron pipe was formerly used in practically all economizer construction because cast iron resists corrosion better than steel. This type of economizer is still suitable for low or medium pressures, but cast-iron is not reliable under the higher boiler pressures now in common use, so steel-pipe construction is standard practice in high-pressure boiler installations, with deaerators to rid feedwater of air and other corrosive gases before it enters the economizer. Tubes are kept free of soot on the outside by built-in soot blowers similar to those used in watertube boiler settings.

Fig. 4 shows a steel-tube economizer element fitted with a finned casting to increase the area of heat-absorbing surface. The tubes are expanded into steel cross-box connections, as shown, and there is a cleanout plug opposite each tube hole. For support only, the banks of tubes pass through holes in cast-iron plates. They are inclosed by cast-iron plates lined with insulating material.

Economizers offer considerable resistance to the passage of flue gas, so some form of mechanical draft must be installed when they are used. They take up space, add to the initial cost of installation, and involve extra maintenance cost for cleaning and repair. On the other hand, economizers may effect quite a large saving in fuel consumption since a 50-deg temperature increase saves about 5% of the fuel. They increase boiler efficiency substantially when boilers are operated at a high percentage over normal rating. Higher feedwater temperatures tend to reduce boiler stresses.

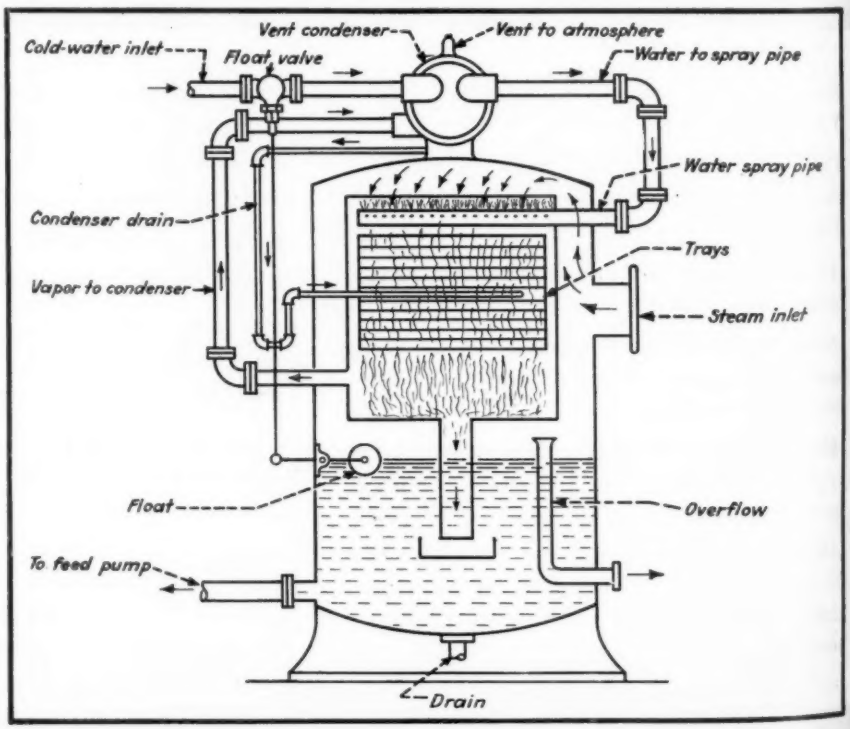

Fig. 3—Deaerating heater warms the feedwater and removes dissolved oxygen

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REFRIGERATION NOTEBOOK — 17

Lubrication Pointers for Refrigerating Compressors

By TERRY MITCHELL, ME, *Frick Company*

A PRESSURE LUBRICATING SYSTEM for either ammonia or Freon-12 compressors must: (1) keep oil level below bottom of connecting rods (2) be free from any tendency to gas bind (3) provide oil at more than crankcase pressure despite worn or loose bearings (4) lubricate stuffing box or shaft seal at crankcase pressure only (5) operate satisfactorily regardless of direction of shaft rotation (6) permit adding fresh oil without admitting air or shutting down (7) strain or filter the oil at pump intake. Larger machines require, in addition, pressure lubrication on the "bearing side" of cylinders, and generally to the suction intake: these services are furnished by a belt-driven mechanical sight-feed lubricator.

In the diagram, oil-pump gears are driven by a pin extending from the crankshaft end. Oil pressure is adjusted by a spring-loaded regulating or relief valve that bleeds excess oil back to crankcase. Drilled passages and tubes carry oil to bearings, cranks and wrist pins. An equalizing line prevents gas-binding, which might otherwise be caused by slight heating at the shaft seal. This relief line also lets stuffing box or seal operate in oil at crankcase pressure.

Main oil pressure can be adjusted for 10 to 50 psi above ammonia suction pressure. Ten psi is minimum pressure for small and medium-sized machines, 20 psi for large units. (In Freon-12 compressors the pump is preferably submerged in the oil to avoid suction lift, and the screen oil strainer is replaced by a self-cleaning filter of the disk-and-comb type. This is because Freon-12 loosens scale from piping and brings it back with oil returning in the suction gas.)

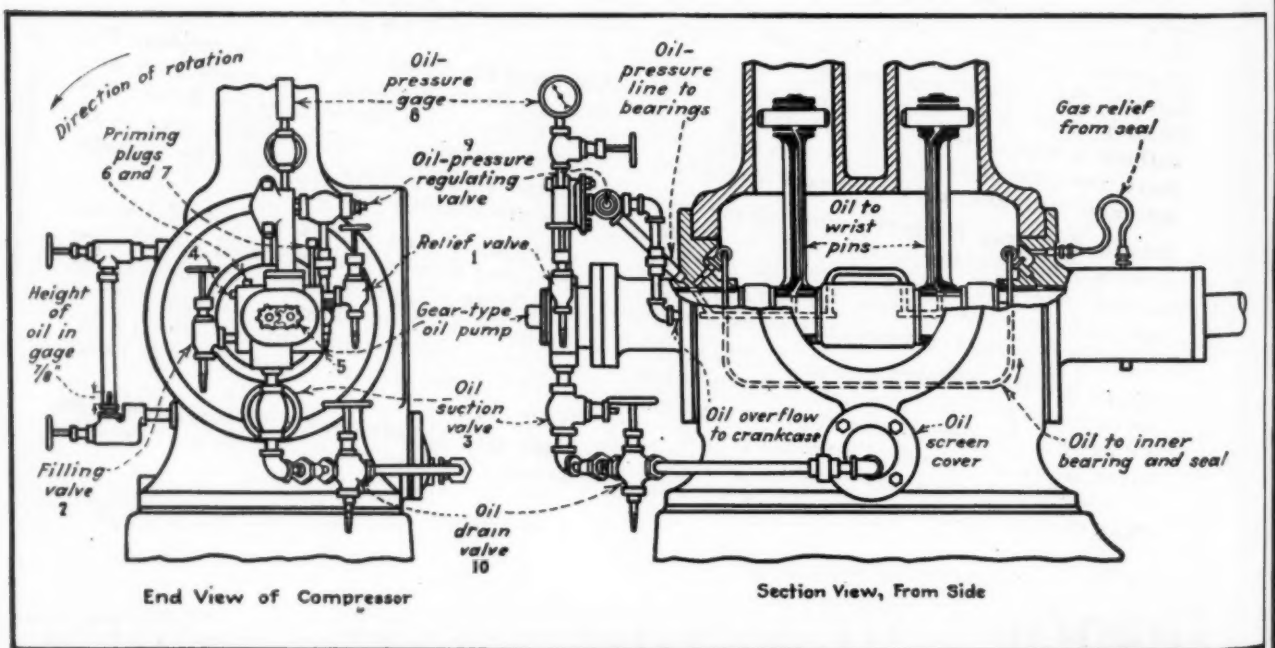
Adding Fresh Oil

To charge fresh oil, attach pieces of hose to valves 1 and 2, and submerge free ends in a bucket of clean oil. Close valve 3 and open 2. Open 1 slightly a few seconds, or until oil flows freely; then close it. Just before pail is empty, or when enough oil has been added, close 2 and open 3 to insure continuous bearing lubrication. Correct oil level varies with each machine.

To run machine in opposite direction to that arrow shows, interchange valves 1 and 2 with plugs 4 and 5. When starting compressor the first time, pour oil into pump through priming plugs 6 and 7. Drain oil out of a new machine through valve 10 once a week for first three or four weeks, and every three or four months thereafter. Clean oil filter at the same time.

Formerly refrigerating machine builders issued oil specifications, but left it to the operator to buy the right oil. This worked most of the time, but the owner, having no good way to check quality, occasionally got an unsuitable oil. Oils not refined sufficiently for refrigeration generally contain moisture, which freezes in the expansion valves, or wax, which deposits in cold evaporators: others have impurities which in the presence of ammonia form sludge or cement. Pistons have been stuck so tightly in cylinders by this cement that they had to be driven out with sledges. Many manufacturers now furnish oil guaranteed to suit their equipment.

Good oil is fluid enough to distribute well over the bearings, yet has body enough not to atomize at working temperatures. It absorbs only a minimum amount of refrigerant, resists thinning out, and does not congeal in coolers.



A modern force-feed oiling system supplying the bearings and shaft seal on a 7x7-in. ammonia compressor

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Silica Scale is Bad Medicine"*

Says Jay T. Nickelson

Nalco Representative,
Tulsa, Oklahoma

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Bear in mind Joe, all water treatment is *not* alike ... remember, the Nalco system is *the complete system.* Ask for a survey today.

Photo in Nalco Laboratories

* Joe, a Chief Engineer at a Railroad Hospital has boiler trouble because of excessive amount of silica in the feedwater. He says — "a recommended compound helps a little but what we need is water treatment."

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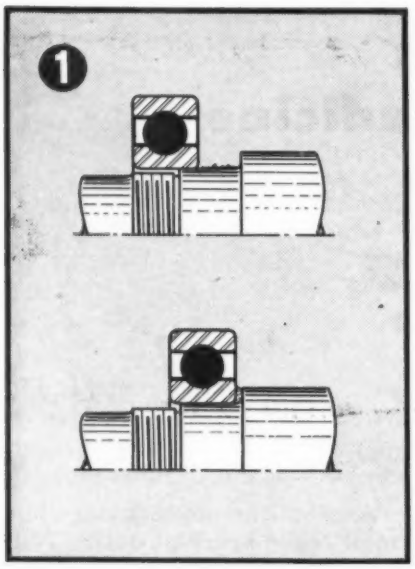
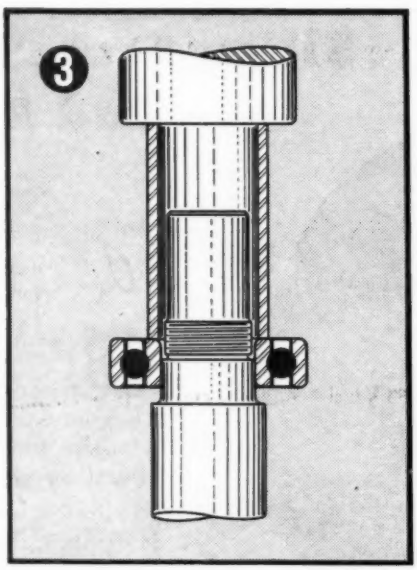
HOW TO SAFELY REMOUNT BALL BEARINGS

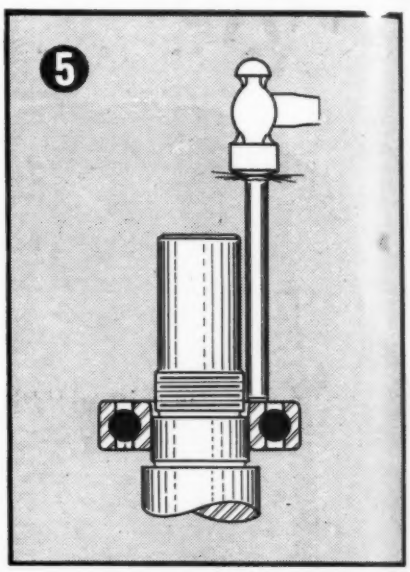
NEVER SPIN A BALL BEARING before it has been cleaned. An otherwise good bearing can be ruined by this practice because dirt scratches on a ball or race may later develop into spalling. Never wash bearings that carry seals or shields on both sides. Normally these bearings are clean and washing may drive dirt particles inside, also the cleaning fluid cannot be completely removed.

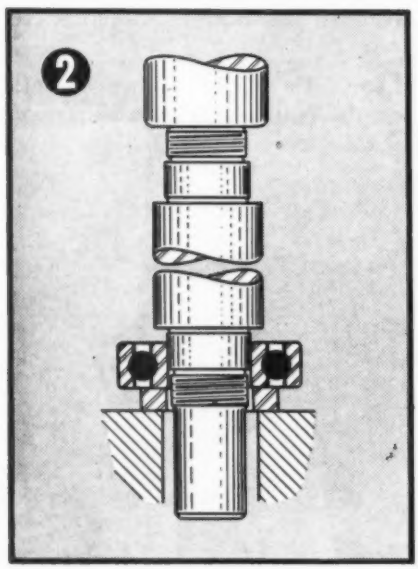
Most ball bearings fail from causes that are preventable. Look for the cause behind every failure and remount the bearings correctly to prevent damage to them and avoid trouble in the future.

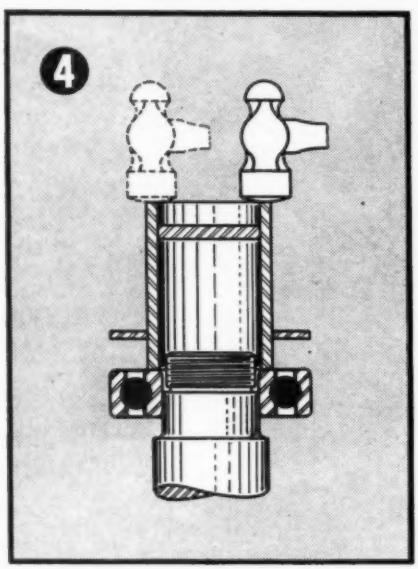
Courtesy of the New Departure Division, General Motors Corporation.

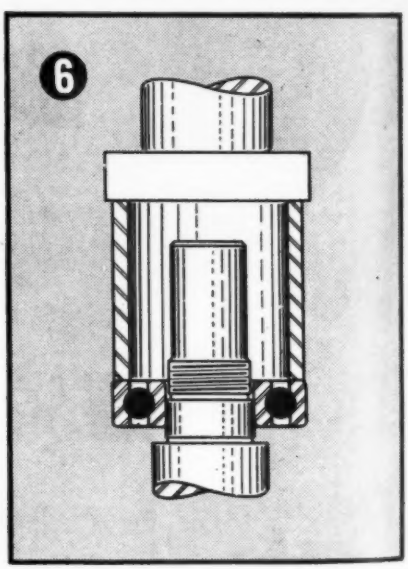












1 Always clean the shaft and give it a light coat of oil before attempting to mount the bearing. Dirt or chips that are trapped between race and shoulder prevent seating.

2 An arbor press serves best for mounting ball bearings. Place two flat blocks of the same thickness under the inner race. Hold shaft from cocking and apply pressure carefully.

3 When the distance from shaft end to bearing seat is short use a piece of pipe on inner race to move it home. Pipe must be clean inside and outside and must have squared ends.

4 When an arbor press is not available use a tube and hammer. The inside and outside shields prevent jarring dirt into the bearing. Hammer on the opposite sides alternately.

5 Using a hammer and drift is poor practice and may cause injury to the bearing. At best, the bearing is cocked from side to side and damage may not show up until it is operated.

6 Never apply mounting force to the bearing outer race. This places a heavy thrust load on the balls and races. If they are not designed for this load, serious damage may result.

Something new has been added to diesel engine cylinder liners—a new process to lengthen cylinder liner life and give the engine greater reliability—more hours of continuous operation.

Chrome-plate, applied to cylinder liner bores, multiplies liner life 4 to 20 times, ring life 3 to 5 times, and reduces the risk of piston seizure.

Every Baldwin diesel engine now coming from the production line is fitted with chrome-plated cylinder liners.

All this adds up to more satisfactory service and lower maintenance cost for your Baldwin diesel.

Baldwin 4-cycle diesel engines are serving railroad, marine, pipe line, power house and other industrial installations—capacities from 150 to 1,050 horsepower.

The Baldwin Locomotive Works, Locomotive & Ordnance Division, Philadelphia, Pennsylvania, U.S.A. Offices: Philadelphia, New York, Chicago, Washington, Boston, Cleveland, St. Louis, San Francisco, Houston.

BLW THE BALDWIN GROUP **BALDWIN**

DIESEL ENGINES

FOR THE ENGINEER'S BOOKSHELF

PRINCIPLES AND PRACTICES OF FLOWMETER ENGINEERING.....*By L K Spink*
SEAMLESS TUBE DATA BOOK.....*By Seamless Steel Tube Institute*
DIRECT-CURRENT CIRCUITS.....*By Earle M Morecock*
PRODUCTION, JOBS AND TAXES.....*By Harold M Groves*
ENGINEERING PAPERS—FOURTH ANNUAL CONTEST.....*By Hydraulic Institute*
ARC AND ACETYLENE WELDING.....*By Harry Kerwin*
DIESEL ENGINE CATALOG (VOL NINE).....*Edited by Rex W Wadman*
BOOKLETS.....*Brief Reviews*

Flowmeters

PRINCIPLES AND PRACTICES OF FLOWMETER ENGINEERING (1943) (*6th edition*). *By L K Spink. Published by The Foxboro Co, Foxboro, Mass.* 220 *pp*, 5¼x7½ *in. illustrated*, 39 *tables, semi-flexible binding.* $3.00.

Meter engineers will find this handbook a valuable contribution to flow-metering literature. In this enlarged edition new and advanced phases of the subject are covered for the first time, bringing the book up to date and adding to its usefulness. It contains all the formulas needed for any ordinary liquid- or gas-flow computation.

The work is divided in two parts: liquid- and gas-flow measurements. Featured in the liquid-flow section are these methods: (1) determining compressibility factors of liquids at temperatures near the critical (2) new and more accurate way of correlating temperature expansion data on petroleum oils (3) correcting quickly for tap locations (4) short cut in correcting for viscosity.

Gas section suggests several methods of correcting for viscosity effects. Presented are theoretical discussion, as well as working equations and tables for moisture and super-compressibility; new and simple pressure device which eliminates bypassing gas; latest findings on pulsating-gas-flow measurements. The many examples, worked out to show how the different formulas are used, add much to the book's usefulness.

Electricity

DIRECT-CURRENT CIRCUITS (1944) *By Earle M Morecock, supervisor of electrical dept, Rochester Athenaeum and Mechanics Institute. Published by Harper & Brothers,* 19 *E* 33 *St, New York* 16, *N. Y.* 387 *pp*, 6x9 *in.*, 267 *illustrations, cloth.* $3.25.

Text is one of a series prepared by the faculty of Rochester Athenaeum and Mechanics Institute as part of its program for developing teaching materials closely related to industry. It provides a basic course in dc circuits for technical institutes, junior colleges and industrial and extension schools. It is also valuable to those who have to depend on self-study to further their education. Many problems, with answers, are given at the end of each chapter.

The ten chapters cover: elementary electric circuits; magnetism and electromagnetism; instruments and methods for measuring voltage, current and resistance; power and energy; conductors and insulation; batteries; other electric circuits; the magnetic circuit; electromagnetic induction; capacitance—electrostatics. As indicated by the chapter headings this is a book on dc circuits and magnetism and deals with electrical machinery only incidentally. However, the practical treatment of the different subjects makes it useful to most students of electricity and magnetism.

Economics

PRODUCTION, JOBS AND TAXES (1944) *By Harold M Groves. Published by McGraw-Hill Book Co,* 330 *W* 42*nd St, New York* 18, *N. Y.* 116 *pp*, 5¾x9, *cloth.* $1.25.

Not a government agency, but a private committee of leading businessmen, the Committee for Economic Development has long been laying foundations for good business and national prosperity after the war. This study is the first of a series of reports to be published under the Committee's auspices. Author Groves is professor of economics at the University of Wisconsin and has had long experience in tax studies and public finance. Main theme is postwar revision of the federal tax system to help achieve higher production and more jobs.

Chapters include: Integration of Corporate and Personal Taxes, Excess-Profits Tax Repeal, More Generous Allowance for Business Losses, More Freedom in Depreciation and Obsolescence Accounting, Role of and Changes in the Personal Income Tax, Capital Gains and Losses, Mitigation of Discrimination against Irregular Income, Overhauling Death Taxation, Special Excises and General Sales Taxes, Experience (Merit) Rating in Pay Roll Taxes for Unemployment, Special Taxation Problems of the War Related to Reconversion, Fiscal Policy in the Postwar Period, Consideration of Objectives to the Tax Modifications Here Proposed.

Pump Problems

ENGINEERING PAPERS—FOURTH ANNUAL CONTEST (1944) *Published by Hydraulic Institute,* 90 *West St, New York* 6, *N. Y.* 210 *pp*, 8½x11, *illustrated, paper.* $1.50.

Beginning in 1940, the Hydraulic Institute has held an annual engineering essay contest to stimulate interest in problems of the pump industry. This book comprises five papers of outstanding merit submitted in the 1943 contest. They are: "Special Operating Conditions of Centrifugal Pumps," by A J Stepanoff, development engineer, Ingersoll-Rand Co; "A Common Language for Hydraulic Engineers," by Charles J Tullo, chief draftsman, engineering division, Worthington Pump & Machinery Corp; "Critical Speed," by Alexander Brkich, engineer, Ingersoll-Rand Co; "Direct-Acting Steam Pumps," by Darwin F Schaub, application engineer, Worthington Pump & Machinery Corp; "Effects of Entrained or Dissolved Gas on Rotary-Pump Performance," by Morgan B Sennett, engineer, DeLaval Steam Turbine Co.

Two of the papers, "A Common Language for Hydraulic Engineers" and "Direct-Acting Steam Pumps," are practical and useful to operating engineers; the others are mathematical and intended for pump designers. Of the two practical papers the former is a 49-page discussion of different parts of centrifugal pumps; the latter contains 47 pages of practical suggestions to make present-day steam pump equipment meet wartime production requirements.

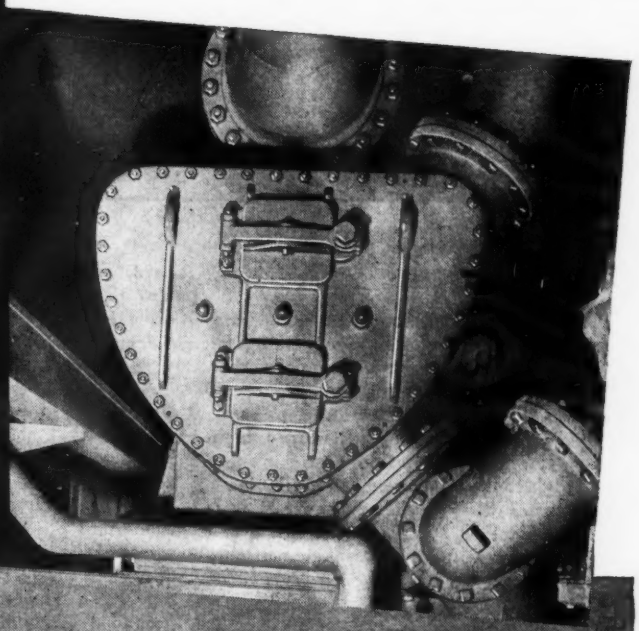
Welding

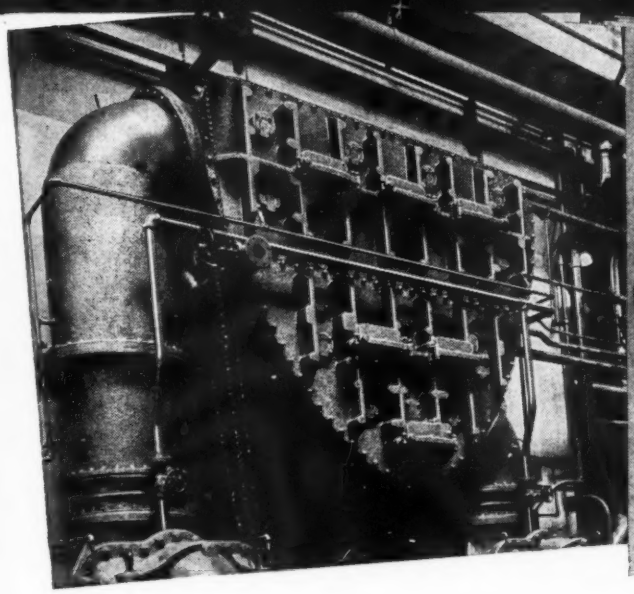
ARC AND ACETYLENE WELDING. By Harry *Kerwin, formerly of California Polytechnic School, San Luis Obispo, Calif. Published.* 1944, *by McGraw-Hill Book Co,* 330 *W* 42*nd St, New York* 18, *N. Y.* 240 *pp, illustrations and diagrams,* 5½x7¾, *cloth.* $2.50.

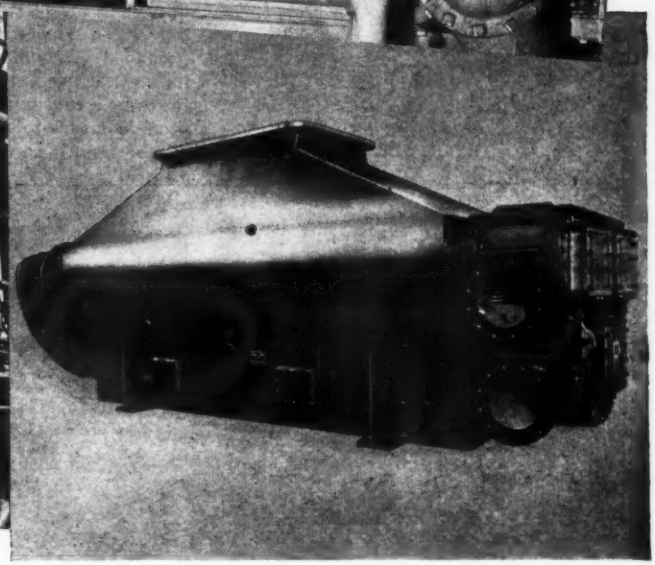
Labeled on the cover "A McGraw-Hill Practical Manual," the book is exactly that. It contains no mathematics or abstract theory: its sole purpose is to show the reader how to make sound welds. Emphasis is on technique—how to handle flames and

(*Continued on page* 148)

Marine? Industrial? ...or Utility?







We can be helpful in tube alloy specifications

THROUGH its long experience in the designing and construction of heat transfer equipment, the Ingersoll-Rand Company has been a consistent user of Anaconda Tubes and Tube Sheets.

Illustrated here are condensers for marine service, for an industrial plant and for a public utility, each presenting an individual problem, not only in design and manufacture but in tube specification as well.

The wide variety of available copper alloys, ten standard and several special alloys, the engineering experience and research facilities that have been of assistance to Ingersoll-Rand and to so many other manufacturers and users of heat transfer equipment, are at your service. Publication B-2 lists Anaconda Condenser Tube Alloys, compositions and fields of applications. We'll be glad to send you a copy. 4418G

ANACONDA

Anaconda Condenser Tubes

THE AMERICAN BRASS COMPANY—General Offices: Waterbury 88, Connecticut

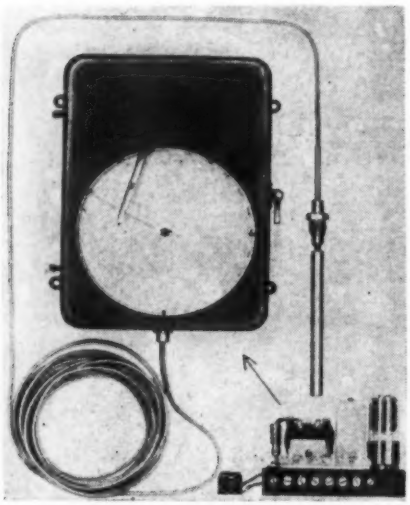
Subsidiary of Anaconda Copper Mining Company—In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

What's New in Plant Equipment

Control Instruments

FREE-VANE ELECTRONIC controller operates on shielding effect of a vane passing between two coils in an electronic circuit. Recording and indicating models are for automatic control of temperature, pressure, liquid level and humidity. Low-open, high-open, low-high, low-open-high and low-normal-high control operation are available.

Temperature controller ranges from —125 to +1000 F for use with motor and solenoid valves, relays, main-line switches



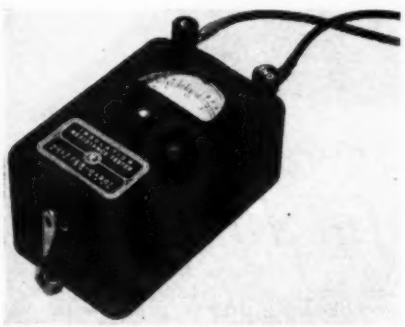
and other fuel-control apparatus. Pressure control is in ranges from full vacuum to 6000 psi and is also suitable for automatically controlling liquid level. Humidity controller operates from a wet and dry bulb element, with separate control for each bulb. Free-vane electronic controller is also offered as a time program controller for automatically controlling temperature, pressure, liquid level or humidity to a definite time schedule. *Bristol Co, Waterbury* 91, *Conn.*

Insulating Materials

FOUR INSULATING MATERIALS have been added to company line. Black *Eagle Swetchek*, an insulation for minimizing condensation on cold-water lines, water coolers and softeners, storage tanks, filters and condensers, is a prepared plastic coating resistant to abrasion. *Eagle Drycote* also combats condensation. It is a plastic coating, white in color, and packaged in dry form. It is highly fireproof. *Eagle Hadesite*, in salmon color, is a fireproofing insulating cement for high-temperature work. Hadesite is used for temperatures to 1900 F. *Eagle* 43 finishing cement is for finishing interior insulation work where an extremely hard, smooth surface is desired. It can also be painted and withstands temperatures to 800 F. *Insulation div, Eagle-Picher Sales Co, Cincinnati, Ohio.*

Electric Soldering Irons

HEXACON ELECTRIC SOLDERING IRONS are now equipped with a ground wire, which minimizes possibility of operator receiving a shock and prevents blown fuses and damage to electrical apparatus. This is through the use of a 3-wire cord set. Two wires are regular conductors and the third is grounded to outer housing of soldering iron. Attachment plug cap has three prongs instead of conventional two prongs. Third prong connects to ground wire. Equipment can be used only where three wire outlets are available. Two most popular designs are Hubbell No. 7055G with straight prongs and Hubbell No. 7554G Twistlock. Equipment is available on Hexacon irons in following wattages: screw-tip irons—50, 60, 90, 120, 130, 175, 250, 350, 500 and 700; plug-tip irons—40, 80, 100, 130, 150, 175, 200, 250, 300 and 550; hatchet irons—80, 100, 150, 175 and 200 *Hexacon Electric Co.*, 131 *W Clay Ave, Roselle Park, N. J.*



Insulation Resistance Tester

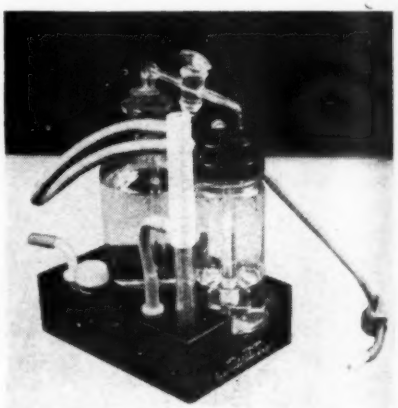
HOLTZER-CABOT UNIT tests insulation resistance of electrical equipment. Hand generator eliminates batteries or external power supply and delivers 500-v dc testing potential regardless of direction in which crank is turned. Hand generator features no mechanical commutation and eliminates rotating or sliding contacts from measuring circuit. Electronic voltage regulation assures uniform testing voltage over a wide range of crank speeds, providing true scale reading. Two indicator buttons, located above scale, light up when generator is delivering correct testing voltage. Guard circuit eliminates possibility of surface leakage affecting measurements. Unit has 0- to 100-megohm range. *Holtzer-Cabot Electric Co*, 400 *Stuart St, Boston* 17, *Mass.*

Underground Pipe Conduits

MODIFIED THERM-O-TILE keeps out moisture in exceedingly wet or submerged locations. Wide sub-base, beneath standard spread-footing foundation, reduces foundation unit pressure and simplifies mechanics of joining waterproofing membranes so that leakage is impossible. In construction, standard design is hermetically sealed by surrounding entire conduit with a membrane waterproofing, and then placed on top of additional sub-base. Waterproof membrane usually consists of 15-lb asphalt-saturated felts laid in hot asphalt and finished with a top mopping of hot asphalt. Sub-base rests on driven piling if wet supporting soil is not sufficiently solid. *H W Porter & Co*, 825 *Frelinghuysen Ave, Newark, N. J.*

Forged-Steel Micrometers

BLACK ENAMEL FINISH forged-steel micrometers, from 1 to 6 in., are available at prices lower than polished frame type. Improved forged-steel polished-frame micrometers with decimal equivalents are in 1- and 2-in. sizes. Micrometers are available with ratchet stop, lock nut and 10,000ths graduations, as well as a full range of metric models. *Central Tool Co, Auburn, R. I.*



Feedwater Test Kit

AERO-TITRATER determines hardness, calcium and magnesium in water. Apparatus also provides micro-determination of calcium and magnesium in boiler scales, plant ash, rocks, sediments, minerals, etc. Air agitation eliminates tedious shaking by hand. Titrator has a single end-point for stoichiometrically equivalent quantities of calcium and magnesium, regardless of relative amounts present. *Chief Chemical Corp*, 1123 *Broadway, New York* 10, *N. Y.*

Switch Breaker

NO. 1560 CIRCUIT BREAKER is relatively free from extreme high- and low-temperature effects, according to manufacturer. Actual trip temperature without current flow is 350 F, ambient temperature, accomplished by new bimetal design. High differential between operating and breaking temperatures is an outstanding characteristic. Bi-

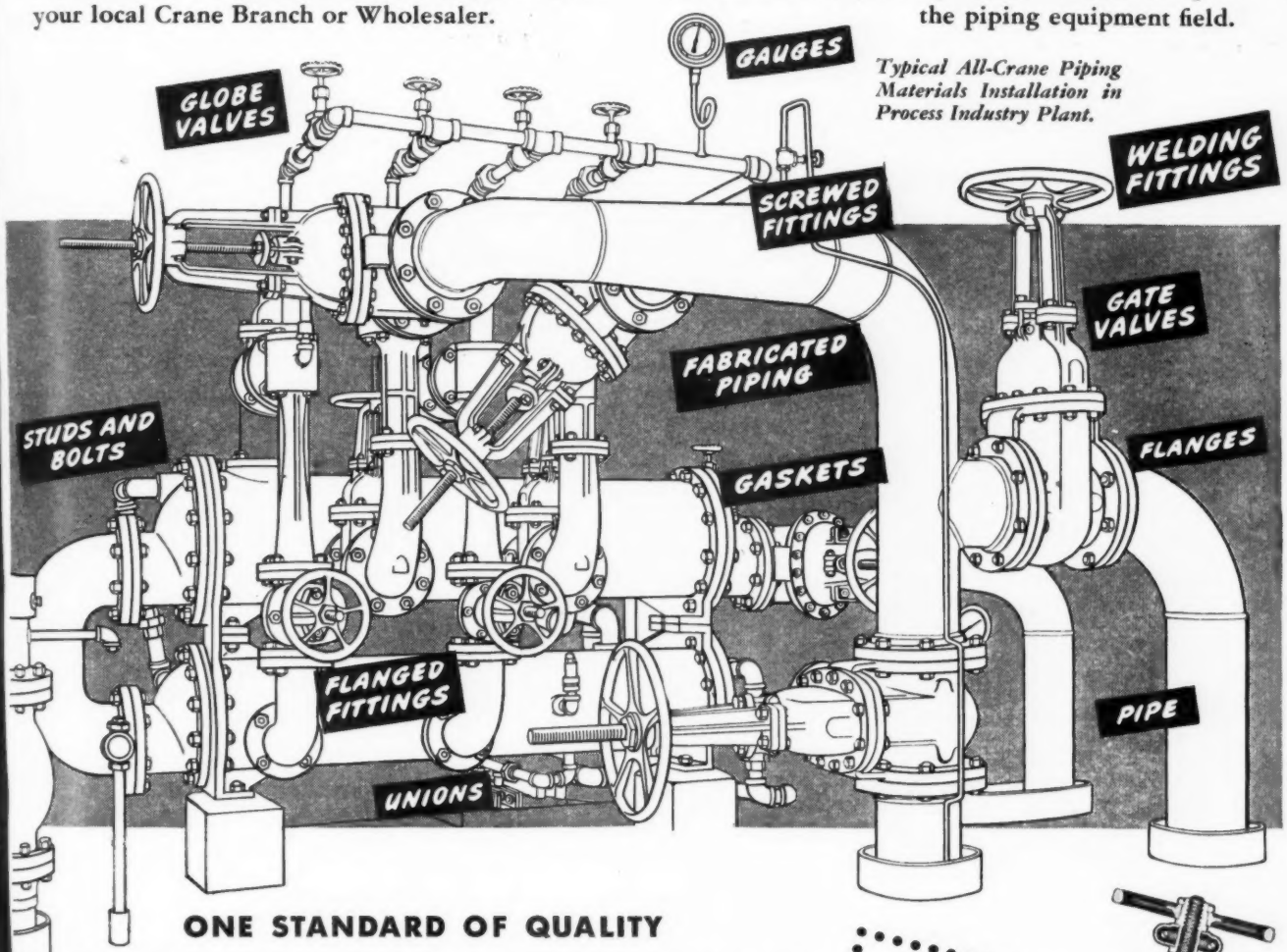
(*Continued on page* 154)

Piping Materials for Any Need ...Crane Can Supply Them

ONE SOURCE OF SUPPLY . . . ONE RESPONSIBILITY FOR ALL EQUIPMENT

The easiest way to dispose of piping supply problems is to put them up to Crane. Doing that gives you the world's greatest selection of equipment for every service—power or processing systems, high or low working pressures. All your needs of valves, fittings, pipe, fabricated assemblies and piping accessories are supplied from one single source—your local Crane Branch or Wholesaler.

Now when you are trying to catch up with deferred maintenance, Crane *complete* piping materials service is a big advantage. From ordering to installation, every step of the job is simplified. And while one responsibility for materials helps assure the best installations, you are also getting full benefit of Crane Co.'s 89-year experience and leadership in the piping equipment field.



Typical All-Crane Piping Materials Installation in Process Industry Plant.

ONE STANDARD OF QUALITY

Dependable quality guards every part of piping systems when you specify Crane materials throughout. Such quality is exemplified by Crane Iron Body Wedge Gate Valves. Strong body sections resist severest strains. Straight-through ports permit unrestricted flow. A deep stuffing box lengthens packing life. Long guides keep disc travel true, while the finest design in every part assures long life and smooth, trouble-free service.

Crane Co., General Offices: 836 S. Michigan, Chicago 5, Ill.

Branches and Wholesalers Serving All Industrial Areas

CRANE

VALVES • FITTINGS • PIPE
PLUMBING • HEATING • PUMPS

Candid(ate)ly Speaking . . .

This is November, the month when all America goes to the polls to cast its ballots for a candidate—then holds a Thanksgiving celebration because the commotion is over. This is November, 1944—but most of the elements of our "modern" election procedure are a couple of thousand years old.

The ancient Roman voted by casting a little white ball (meaning "yes") or a little black one (meaning "no"—hence our "blackballing" a prospective lodge member) into a container that looked like our wastebasket. He "cast a ballot"—meaning *threw a ball.* Voters were counted by the head—or *poll*—at the *polling* place.

Roman campaign advertising was essentially simple—office seekers wrote campaign slogans on walls, then rubbed their robes with white chalk to prove they were clean and honest. The Roman word for white was *candid*—hence our *candidate.* A campaign tour was an *ambitio*—whence our *ambition.*

Don't imagine from this that there's nothing new in politics. America contributed such readily understood phrases as "stump speeches", "taking the stump", "sit on the fence" and "take a walk." But Francis S Dutton, an Australian, introduced the secret ballot—first used in America in Louisville in December, 1888.

Yes, this is November, 1944—and every American still has the right to vote as he wishes—a right which the Romans and their descendants lost long since. Every American has the right, and the responsibility, to express his own considered opinion, and thanks to Dutton, the Australian, he can express that opinion in his ballot secretly—without fear of the opinions or actions of his associates.

Election provides an opportunity for each of us to choose, to be honest with ourselves in selecting the man or men who can do most good for all of us. This is a time for independent thought and honest action.

George Edwards

Engineer

FUEL FIGHTS!

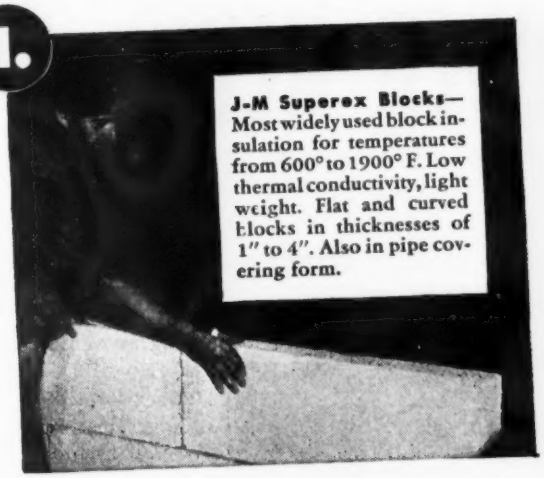
Save it with

Johns-Manville INSULATIONS

AT THE RIGHT are shown three widely used Johns-Manville Insulating Materials—three of many such materials in the complete J-M line that are saving important quantities of "fighting fuel" in thousands of power plants today.

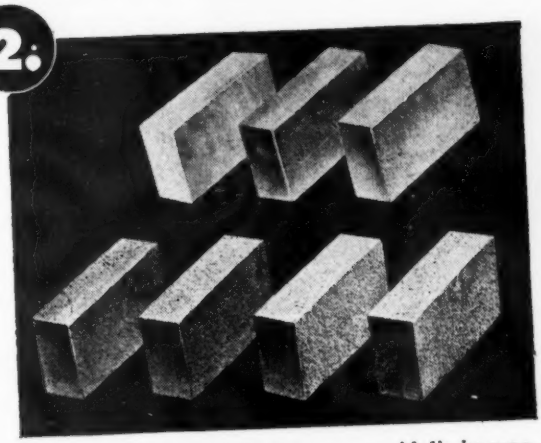
Every insulating requirement of a power-generating plant can be efficiently and economically filled with one or more of the many J-M Insulations. These insulations are the result of Johns-Manville's 85 years' experience in solving every conceivable type of insulation problem. It will pay you to use them wherever possible. For more information write: Johns-Manville, 22 East 40th Street, New York 16, N. Y.

1.



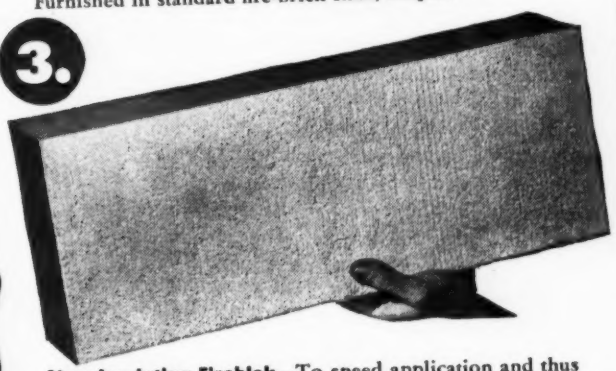
J-M Superex Blocks—Most widely used block insulation for temperatures from 600° to 1900° F. Low thermal conductivity, light weight. Flat and curved blocks in thicknesses of 1" to 4". Also in pipe covering form.

2.



J-M Insulating Fire Brick—Seven types with limits ranging from 1600° F. to 2600° F. Made of a high-quality refractory clay. Has a uniform, controlled pore structure. Furnished in standard fire-brick sizes, shapes.

3.



New Insulating Fireblok—To speed application and thus save many hours' down-time, J-M makes available four new Insulating Fireblok. This insulation differs from Insulating Fire Brick only in size, being about 5 times larger.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville
INDUSTRIAL INSULATIONS
FOR EVERY TEMPERATURE . . . FOR EVERY SERVICE

POWER NEWS

BUSINESS ITEMS AND APPOINTMENTS • WASHINGTON NOTES

CONVENTIONS • MODERNIZATION POINTERS • FUEL CONSERVATION

POWER a Double Winner In Editorial Contest

FOR EDITORIAL ACHIEVEMENT
1944
First Award To
Power
For the best illustrative treatment of editorial material during the twelve months ending July 31, 1944 in the seventh annual competition
conducted by
INDUSTRIAL MARKETING

POWER won a First Award and an Award of Merit in the Seventh Annual Competition for Editorial Achievement, conducted by the magazine, *Industrial Marketing*. The awards were announced at a luncheon meeting in Chicago on September 23.

In the classification "best illustrative treatment," POWER was given First Award—the bronze plaque above—for its "Powered by Electrons," special section in the April, 1944, issue. The 24-page section was written by F A Annett, associate editor. The art layout, in three colors, was made by E P Demarest, art editor. This electronics section was designed to give practical power engineers a foundation for understanding the new developments in electronics and applying them to the problems of power generation and application.

In addition, POWER won an Award of Merit in the classification "best series of articles" for the "Power Handbook," published in December, 1943, and February, 1944. This Handbook, written by Editor Phil Swain, was a condensed presentation of engineering fundamentals for practical engineers. Its publication brought in more than 200 letters from readers.

First Award for "the best series of articles published during the twelve months ending July 31, 1944," went to *Domestic Engineering*. The other First Awards were: "for the best single article," to *Iron Age;* "for the best single issue devoted to a single theme," to *Interiors;* "for the best published research," to *American Artisan;* "for the greatest improvement in format and general appearance," to *Construction Methods*.

Competition for editorial achievement was established by *Industrial Marketing* in 1938, to give business paper editors greater recognition for the "outstanding work they are doing in keeping industry and business informed on the most effective practices for efficient operation."

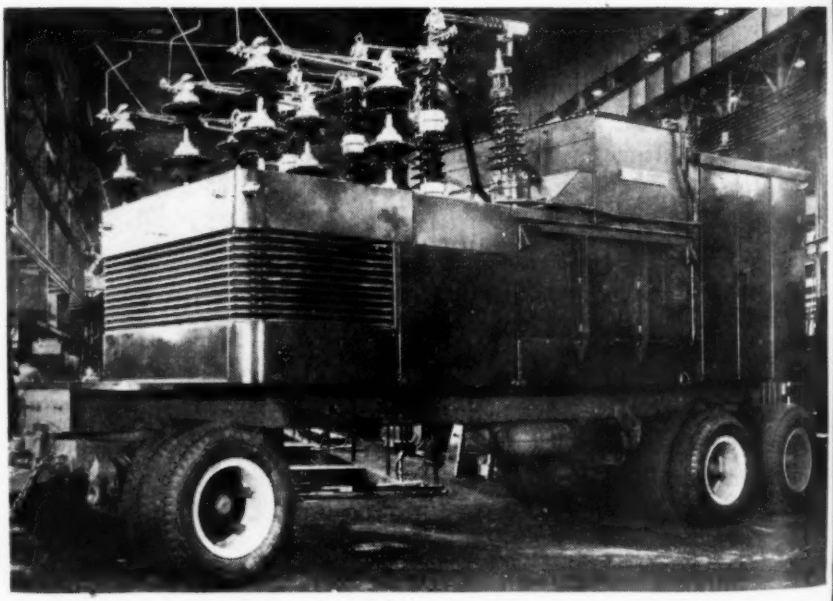
Jury of Awards that picked the winners in this year's competition consisted of: chairman, Roland G E Ullman, of The Roland G E Ullman Organization, Philadelphia, Pa.; Theodore Marvin, advertising manager, Hercules Powder Company, Wilmington, Del.; LeRoy Garretson, advertising manager, SKF Industries, Inc, Philadelphia, Pa.; R E Lovekin, R E Lovekin Corp, Philadelphia, Pa.; W A Fox, Fox & MacKenzie, Philadelphia, Pa., and J Francis Matlack, plant manager, Edward Stern & Co, typographers, Philadelphia, Pa.

Report on Fuel Efficiency Program

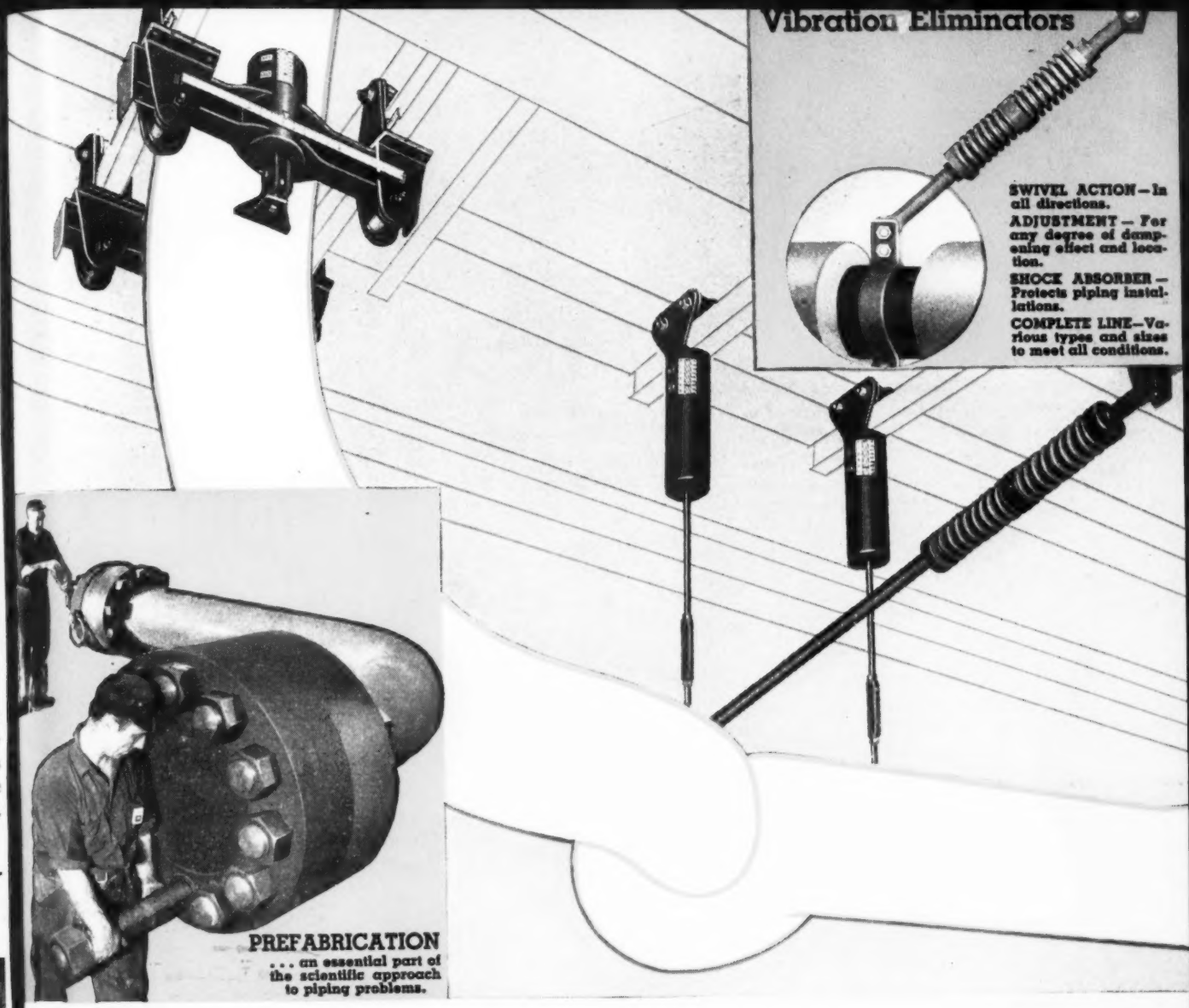
Solid Fuels Administration for War estimates that the country will require about 16 million tons of bituminous coal more than the mines can produce during the year ending Mar 31, 1945.

(*Continued on page* 178)

MOBILE POWER FOR FAIR-SIZED TOWN



This 2500-kva unit substation can be towed at speeds up to 35 mi per hr for emergency power at any part of a system. One of the largest mobile units ever built, it is capable of supplying power for 25,000 100-watt lamps. Complete substation, built by General Electric, includes power transformer, high-voltage fuses and disconnecting switches, feeder oil circuit breaker, lightning arresters for high-voltage circuits and low-voltage metering equipment. Novel is a retractable high-voltage disconnecting switch that permits spreading phases apart for necessary electrical clearances when operating at highest voltages, returning them to normal to meet road clearances during transportation.


Vibration Eliminators
SWIVEL ACTION—In all directions.
ADJUSTMENT—For any degree of dampening effect and location.
SHOCK ABSORBER—Protects piping installations.
COMPLETE LINE—Various types and sizes to meet all conditions.
PREFABRICATION
... an essential part of the scientific approach to piping problems.

FOR A REAL "PROFESSIONAL JOB"

Specify Functional Hangers and Vibration Eliminators

They make possible the installation of the most economical shaped structures by permitting free flexure of the entire piping system in all planes. Spring assemblies are all of the same length at the same elevation away from interconnecting piping, valves, covering, etc., presenting a neat "professional" appearance.

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Clean Linen for Business and Professional Use

August 21, 1944

Mr. R. B. Osgood
Jenkins Bros.
1514 West Fulton St.
Chicago, Ill.

Dear Sir:

With reference to our conversation of last Tuesday, we find that there are over 2500 valves in service in our plant, and all, other than special valves, are Jenkins.

Although the plant, when originally built in 1926, was equipped with four different makes of valves, a survey of our performance and cost records led us to standardize on Jenkins, and all replacements since 1928 have been made with Jenkins Valves.

As you know, when the war started, plants like ours were placed pretty far down on the list of non-essential industries. Finding workers and getting materials for proper maintenance has been, and still is, a tough problem.

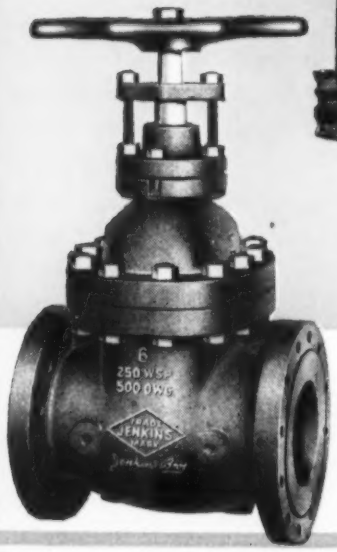
Under these conditions, we have been greatly pleased with the efficient performance of our Jenkins Valves. They have consistently exceeded our expectations, and have helped us materially to keep our plant operating at full capacity. When more valves are required, they'll be Jenkins, for sure!

Very truly yours,

George Wasil

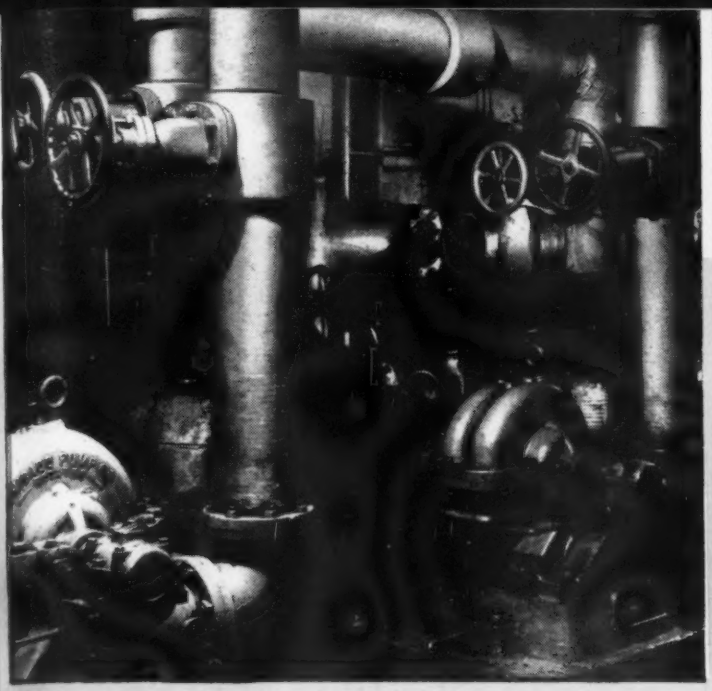
George Wasil, Plant Engineer

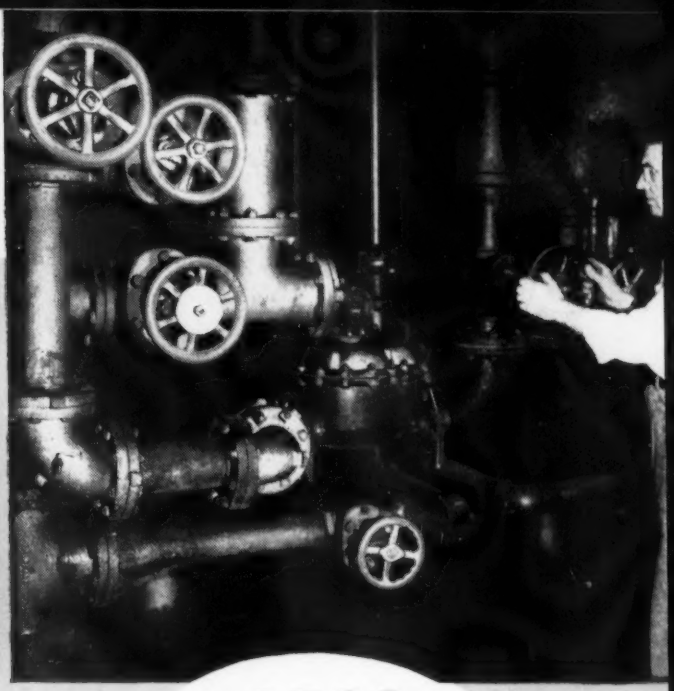
GW-fg



JENKINS VALVES

SINCE 1864





...this "war orphan" business found it paid to have standardized on Jenkins Valves

For the past three years, linen supply houses and laundries have been among the "orphans", getting only what was left in man power and equipment. Their workers were lured away into war industry, and "make it do" was often the only answer to maintenance material needs.

Operating equipment has had to withstand abuse and neglect unknown in peacetime, and still keep plants running efficiently at full capacity.

The American Linen Supply Company, one of Chicago's largest plants of its kind, standardized on Jenkins Valves on the strength of their peacetime record. Under the extra strains of wartime operation, these valves exceeded even the management's confident expectation of trouble-free performance.

Records like this, reported by so many industries serving military as well as civilian needs, all add up to convincing proof that Jenkins Valves *"cost least in the long run"*.

In your plans for reconversion and renovation, it will pay you to specify Jenkins for every valve requirement.

Jenkins Bros., 80 White St., New York 13; Bridgeport, Conn.; Atlanta; Boston; Philadelphia; Chicago; Jenkins Bros., Ltd., Montreal; London.

2500

Valves are required for efficient control of processing fluids in this large linen supply house. Standardization on Jenkins Valves assured dependable performance, simplified maintenance.

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has a complete picture of the valve supply situation at all times. He can keep you informed about valves available, aid you in selection, and provide the help of Jenkins Engineering Service for special problems.

His distinguished service to war industry, often in the face of baffling supply conditions, has prepared him even better than ever to give you the help you'll need for reconversion.

A New Jenkins Price and Discount Sheet, dated Oct. 2, 1944, is now available from your Jenkins Distributor – ask him for your copy.

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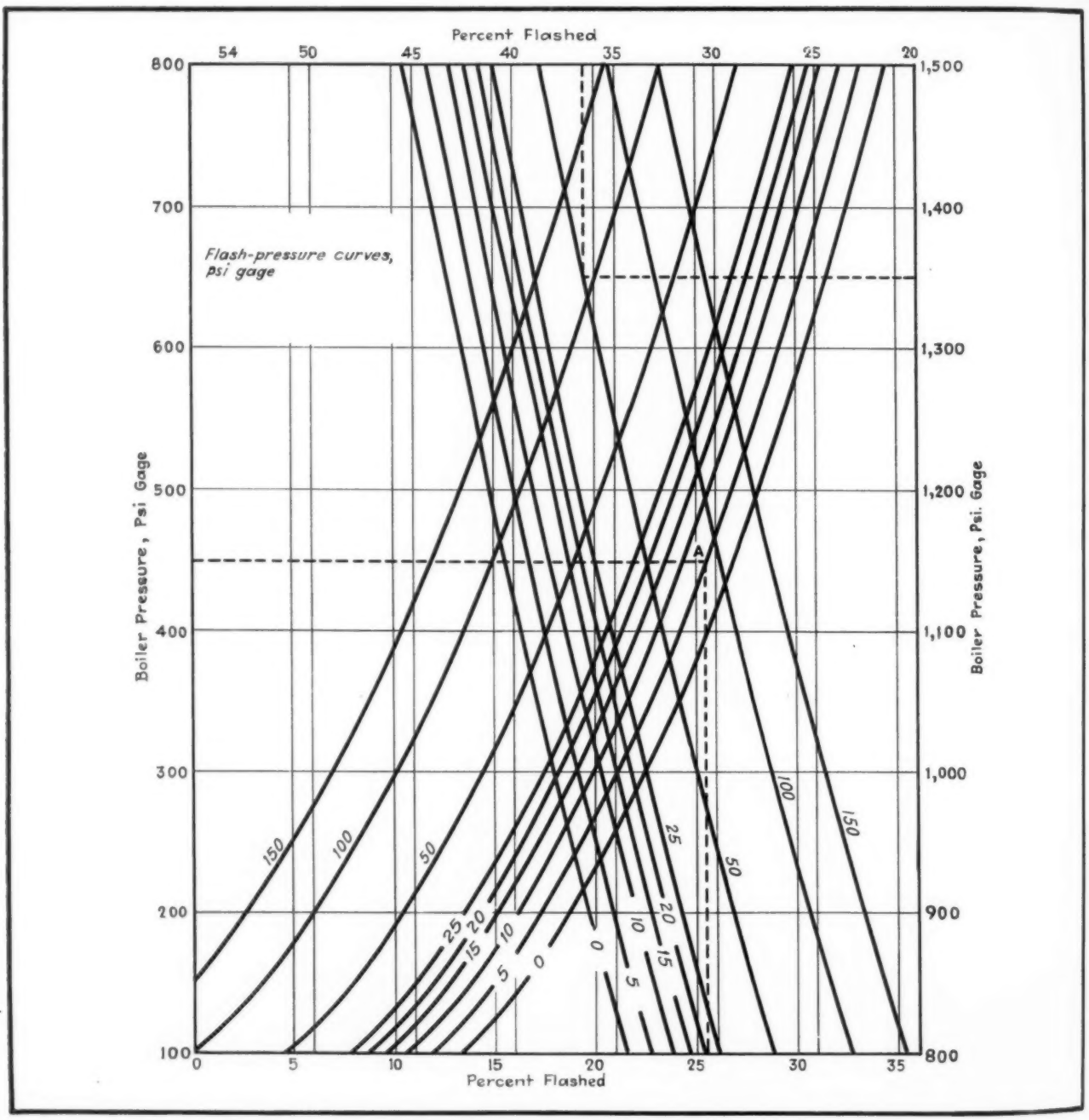
Number 147

Flashed Steam From Blowdown

► CHART INDICATES directly the percent of blowdown quantity that can be recovered as low-pressure steam for any boiler pressure and any flash pressure. For boiler pressures ranging from 100 to 800 psi, use left-hand and lower scales; above 800 psi, use right-hand and upper scales.

For example, a boiler operating at 450 psi gage blowing to a 5-psi-gage flash tank will produce 25½% of the blowdown quantity as useful low-pressure steam available for heating, process or other plant utilization.

Courtesy, W H & L D Betz



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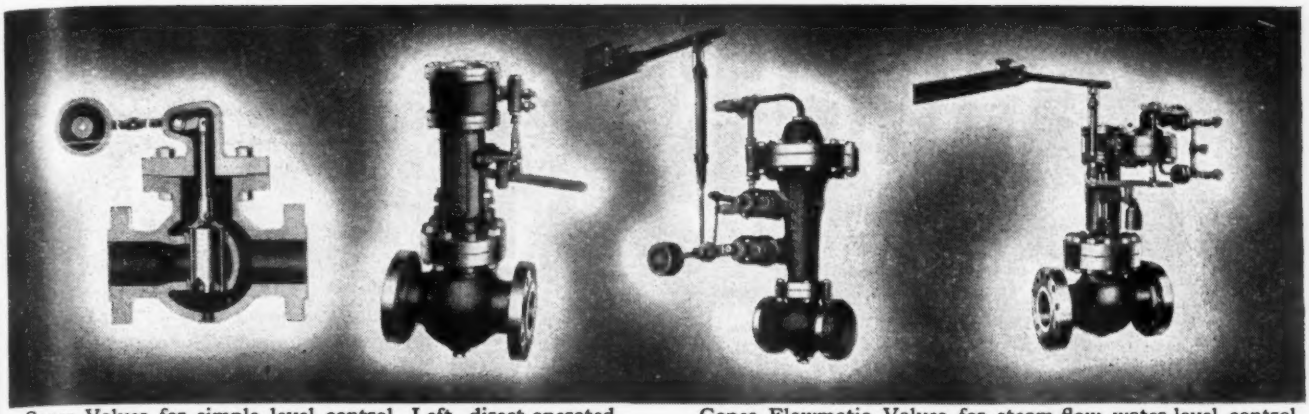

Copes Valves for simple level control. Left, direct-operated. Right, relay-operated.

Copes Flowmatic Valves for steam-flow water-level control. Left, direct-operated. Right, relay-operated.

NO FEED WATER REGULATOR IS BETTER THAN ITS——

PERFORMANCE of a feed water regulator depends largely upon the merits of its control valve. For the valve actually regulates the feed supply. It determines the flow characteristics obtained. It should be responsive to the slightest command of the actuating element. And it should function smoothly and reliably under difficult operating conditions.

That's why Copes Engineers have always emphasized valve design. Years of development and specialization in feed water control have fostered "know how" that we believe cannot be matched. There are several designs of Copes Valves for different classes of service, and to conform to various types of Copes Feed Water Regulators. All embody these valuable characteristics—(1) *Each valve is equipped with valve ports having correct flow characteristics for the job.* (2) *Port areas are designed for the specified maximum capacity.* (3) *Valve plunger has high lift—conducive to accurate control.* (4) *Scientific balancing and minimum friction assure sensitive response without "chatter" or "jumping."*

When purchasing feed water regulators, the soundness of Copes Valve design is an important reason why you should specify Copes. For other reasons write for Catalog 12–41.

NORTHERN EQUIPMENT CO • 1141 Grove Drive, Erie, Pa.

Feed Water Regulators • Pump Governors • Differential Valves • Liquid Level Controls • Reducing Valves & Desuperheaters

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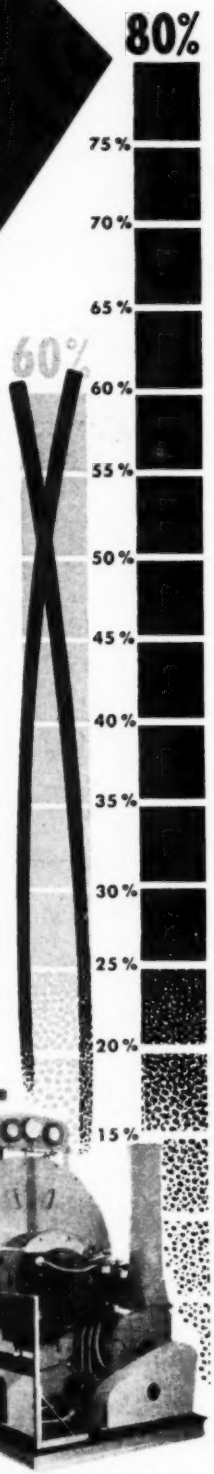
with the new PREFERRED UNIT STEAM GENERATOR



60% efficiency has been the maximum obtainable with the typical industrial steam boiler now in service. And this means, 60% top efficiency *when the boiler was designed*, which was probably fifteen or more years ago. It is doubtless still less efficient after its years of service.

The new, ultra-modern Preferred Unit Steam Generator now makes available a boiler efficiency of 80%.

A complete, compact, portable steam plant that can be set down anywhere and put right to work after making a few simple connections. No stack required, no specially built foundation. Consists of modern boiler, oil burner, induced-draft fan, piping, wiring, controls — all in one perfectly coordinated unit, operating either automatically or semi-automatically. Developed to meet wartime needs — and *proved* under exacting war demands. 20 to 500 HP models.

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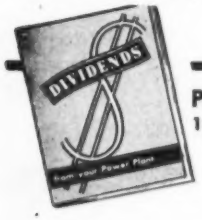

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P 11-44

for Results

PREFERRED UTILITIES

Brush Performance

(*Continued from page* 109)

is sometimes deposited from oil mist in the air. If oil source cannot be removed, or oil mist filtered from the air, brushes with some polishing action usually improve commutator and machine performance. Frequent use of a canvas wiper improves operation under such conditions.

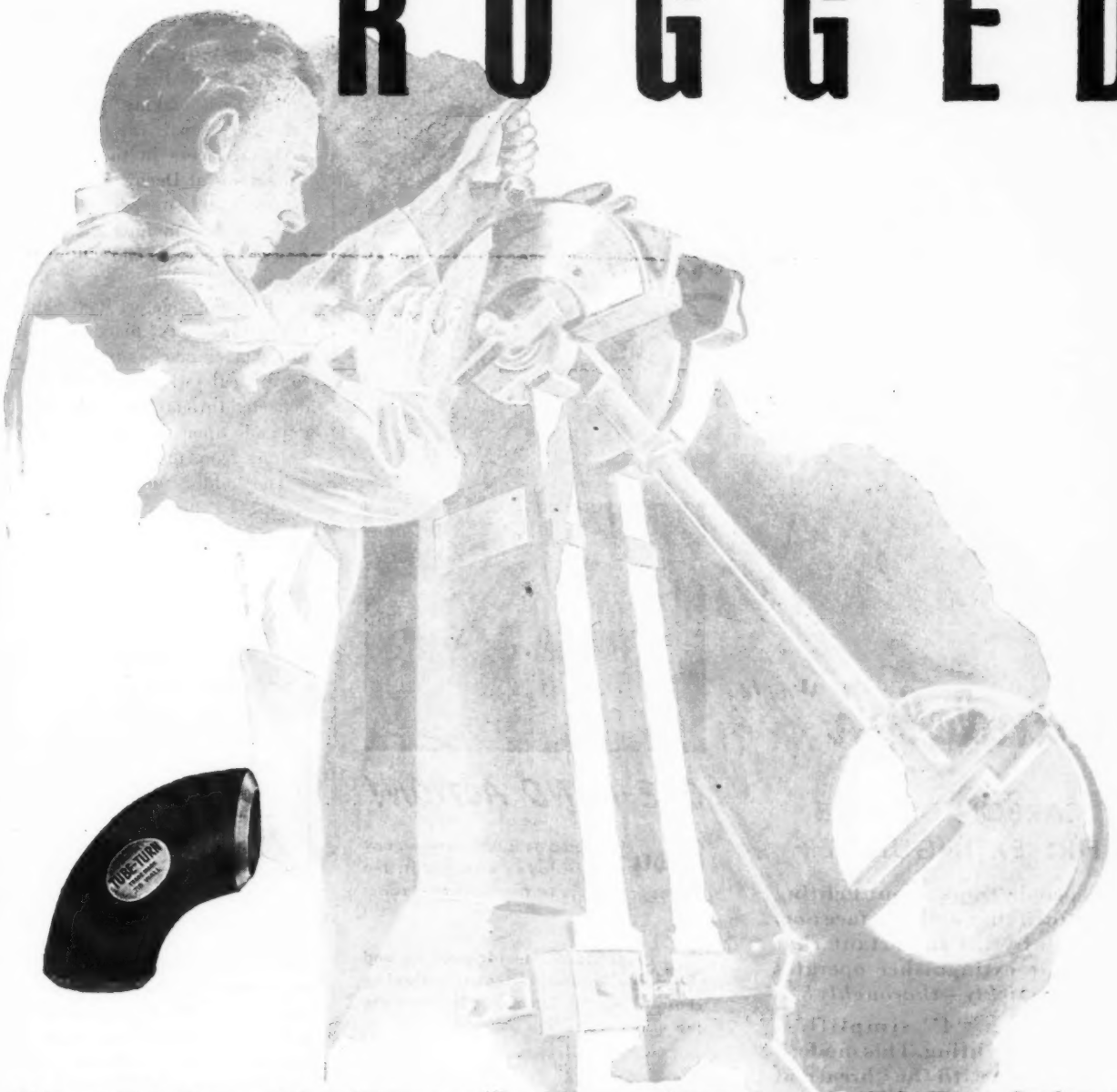
Fig. 8 shows a convenient device for safely applying canvas to a commutator. Several layers of hard-woven canvas or duck are wrapped over the end of a strip of strong, pliable wood and attached by rivets. Countersinking the strip where the rivets are inserted reduces danger of rivet heads coming in contact with commutator. When outer canvas layer becomes worn or too dirty to use, cut it away and expose next layer.

Avoid a raw or bright metallic-copper surface on a commutator because a film of surface oxidation improves commutation and reduces brush friction. Among common causes of a raw commutator surface are use of abrasive brushes, copper accumulation in brush faces, atmospheric contamination, and operation at too low average current density. Some forms of atmospheric contamination impede or prevent a good surface oxide film forming on the commutator, or they may destroy a surface film already established. Carbon tetrachloride, smoke and vapors from hot insulation cause atmospheric contamination injurious to oxide film. Under these conditions, brushes that develop an electrographic film on the commutator surface often improve operation.

This film appears to protect the commutator surface from contaminated air sufficiently for the oxide film to form. Removing enough brushes to bring current density up to an average of 40 amp per sq in. in the others usually corrects a raw commutator surface caused by low average current density. Should the full complement of brushes be required to carry peak loads, change to a brush with better film-forming characteristics.

Lubricating oil that thickens when heated and thins when cooled has been developed in the Richmond (Calif.) laboratories of the Calif. Research Corp, a Standard Oil Co of Calif. subsidiary, *Business Week* reports. Although the new oil is still looked upon as something of a laboratory curiosity, it may help solve the problem of lubricating equipment that has to operate through wide temperature ranges.

RUGGED



The ability of Tube-Turn welding fittings to withstand severe shocks, such as "water hammer" or impact at sub-zero temperatures, is determined *before* they are made. The most modern and accurate machines are used to make izod, tension impact and Charpy tests on materials from which Tube-Turn fittings shall be forged. All tests taken vertify that ruggedness — just downright *toughness* — is *built into* every Tube-Turn fitting by a combination of superior metals, proved designs and exclusive forging processes. Be sure, when designing *or* repairing piping systems, to use fittings from the Tube-Turns Catalog, and to insist on these *original* welding fittings in all specifications.

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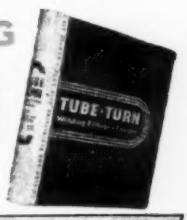
Latest engineering data, exclusive charts, helpful diagrams and tables . . . all in one easy-to-use 240 page volume! Write (on letterhead) for Tube Turns Catalog Number 111.



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KILL FIRE this easy way

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Few people <u>think</u> about fighting a fire until they actually face one. That's why it's important that every fire extinguisher operates *easily—quickly—thoroughly!*

Randolph "4" simplifies, speeds fire-fighting. This modern extinguisher with the "breath of ice" chokes gasoline, oil, paint, machine, electric fires—instantly. Hits the blaze <u>before</u> damage is done!

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Mobilize against fire with Randolph carbon dioxide protection. For complete details and prompt service, call your supply house, or write us—today.

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Neat! Randolph carbon dioxide is dry and odorless. Actually disappears *after* the fire is out. Leaves no foam or liquids to clean up.

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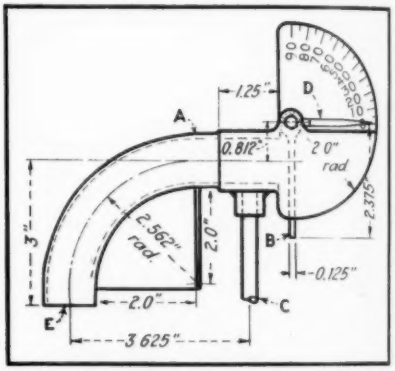
Flap Meter Checks Steam Waste

► OBSERVATION of exhaust pipes frequently shows that steam hammers and pumps are leaking past pistons and valves. To repair the most serious leaks first, engineers in the L.M.S. Railway workshops at Derby, England, designed a simple and rugged instrument so that the regular maintenance staff could quickly ascertain the actual amount of steam lost.

The "flap" meter, in the diagram, is the result. Duct *A* placed over the center of the machine exhaust pipe leads steam to vertical swinging vane *B*, which is deflected through an angle whose degree depends upon the velocity of the steam issuing from the pipe.

The holding device, not shown, consists of a hoop with three clamping screws so arranged that it fits various pipe sizes. Attached to the hoop is a clamp to hold vertical rod *C*, which carries the main meter body. This rod can be raised or lowered and clamped in any position to center duct end about ½ in. from end of exhaust pipe.

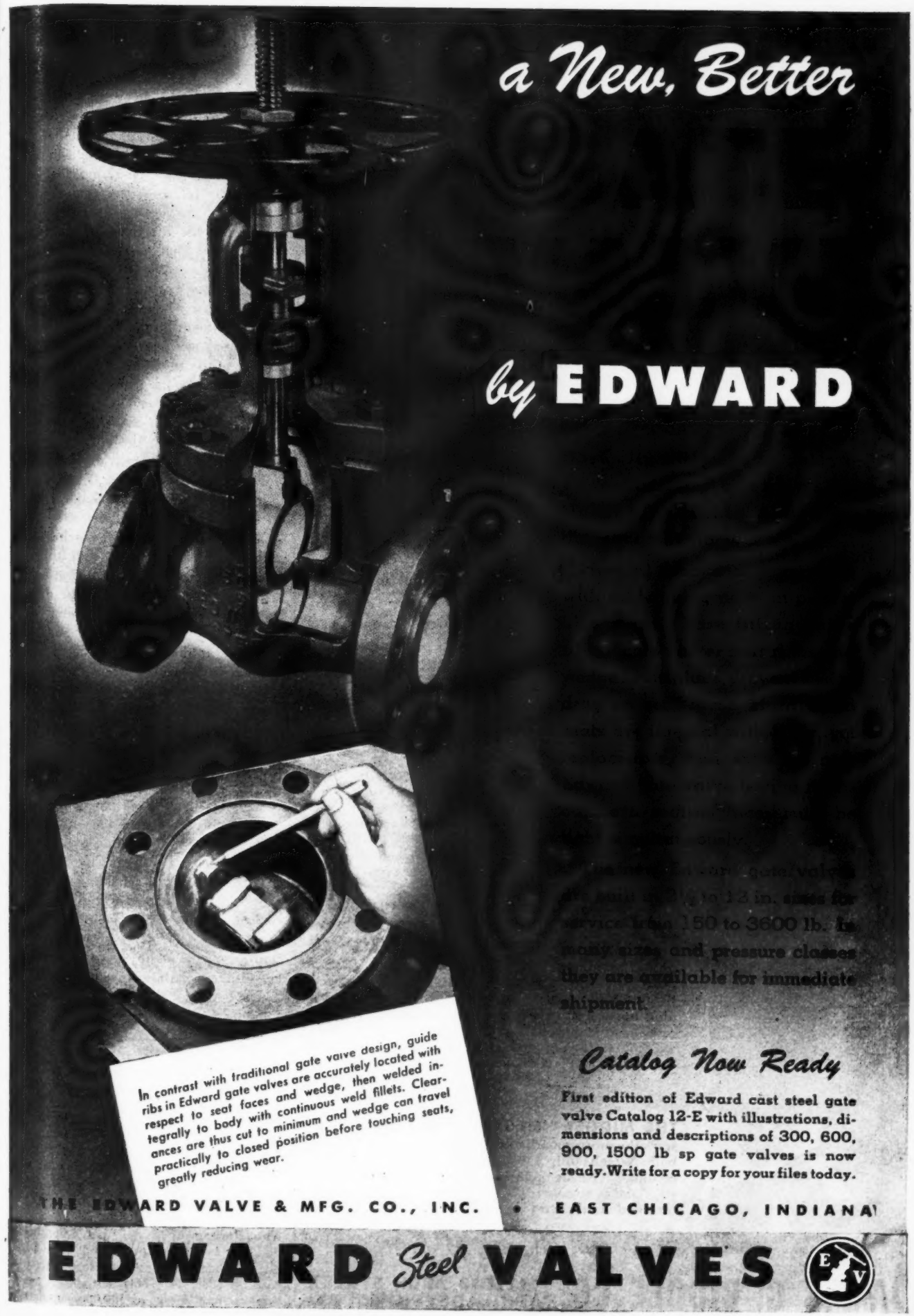


Pipe clamp, fastened to rod *C*, centers the duct opening, *E*, over exhaust pipe

To prevent steam, deflected off its curved undersurface, from striking the lower part of the vane and affecting the readings, the duct carries a baffle. The vane swings on small adjustable pointed bearings so that it moves freely. Fastened to the vane, and at right angles to it, is a light steel pointer *D* which travels over a quadrant scale, marked from 0 to 90. Two different vanes are supplied—one of steel, for relatively heavy steam discharge, and the other of aluminum, for measuring smaller discharges.

Although the main dimensions of the meter were obtained by calculation, calibration was determined by actual test as follows:

If steam at any given pressure is applied to an orifice of definite size, the quantity passed per hour is known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In contrast with traditional gate valve design, guide ribs in Edward gate valves are accurately located with respect to seat faces and wedge, then welded integrally to body with continuous weld fillets. Clearances are thus cut to minimum and wedge can travel practically to closed position before touching seats, greatly reducing wear.
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First edition of Edward cast steel gate valve Catalog 12-E with illustrations, dimensions and descriptions of 300, 600, 900, 1500 lb sp gate valves is now ready. Write for a copy for your files today.
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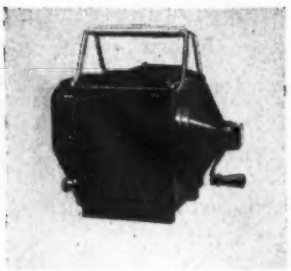
Today's heavy demand on every type of electrical equipment makes maintenance a matter of vital importance. Regular check tests of the insulation on motors, cables, controls and other electrical apparatus will save priceless time through the detection of incipient failures and the application of corrective measures.

Make sure that you have a "Megger" instrument and that it is used regularly and frequently. Minutes with the "Megger" tester can save days of delay. If you are not aware of the protection afforded by the use of "Megger" instruments and their importance in keeping electrical equipment in operation, write for the Pocket Manual of "Megger" Practice, No. 1420-P.



THE NEW U. S.-MADE "MEGGER" INSULATION TESTER—Consists essentially of a direct-reading true ohmmeter of the permanent magnet moving coil type mounted with a d-c hand generator in a plastic molded case. Ranges up to 1000 megohms, with hand generators up to 500 volts. Widely used in hard service. Variable-pressure ("Meg") and constant-pressure ("Super-Meg") types. Bulletin 1735-P.

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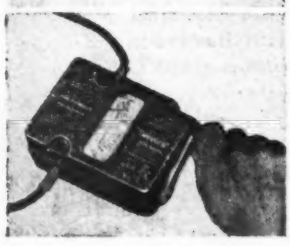

THE MIDGET "MEGGER" TESTER—In many ways the most remarkable "Megger" instrument ever built. Weighs only 3 lbs.—will fit an overcoat pocket or tool kit. Reads up to 50 megohms. Generates 500 volts and is always ready to use anywhere because of the hand crank. Send for Catalog 1690-P.

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within fairly close limits. When steam from this orifice flows through a pipe of known size, the quantity discharged, per sq in. of pipe area, in an hour, can be calculated. This was the method used in calibrating the meter. Various sizes of pipes determined whether scale effect made any appreciable difference; for all sizes of pipe tested the check points lay on the same smooth curve. Height of meter-duct entrance above the pipe, for distances varying from zero to one inch, does not affect readings.

Using the calibration thus determined, a curve shows the relationship between steam discharged, per sq in. of pipe area, per hour and the deflection angles of the steel and aluminum vanes. Pasted inside the carrying-box lid is a table, which gives this relation with the different pipe areas. Thus, if the angle, when using the aluminum vane, is 15 deg. the leakage is 40 lb per hour for each sq. in. of area. If the pipe is 3 in. in diameter, total leakage is 280 lb of steam per hour.

The quantity of steam discharged is affected by its dryness, and this was overcome during the calibration by using steam of about the same dryness as the exhaust that the meter is to measure.

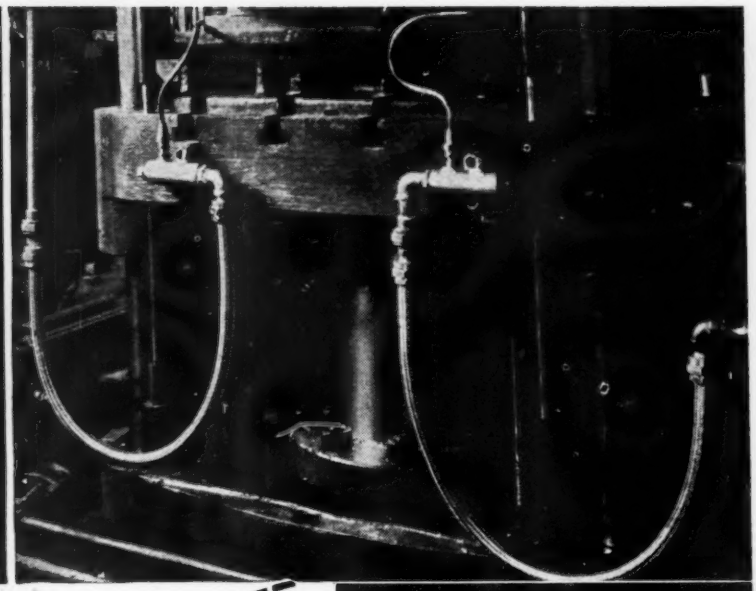
When applied to a steam hammer, leakage is measured when the hammer is held up by steam, and then with it resting on the anvil. This indicates leakage past the piston and valves while the hammer is in operation. A time study then shows how long the machine is shut off during each operation and the loss is figured accordingly.

A steam pump can be tested with the slide valve in mid position to determine leakage past the valve. Find combined leakage past pistons and valves by blocking the piston and applying steam to one side of it without producing movement. The meter also determines improvements made by repairs, which encourages maintenance men to do a good job.—*"The Steam Engineer,"* London, England.

Largest incandescent lamp is a 50,000-watt bulb, bigger than a basketball. It is used occasionally for special flood lighting purposes, costs $500 and consumes enough current to light 600 homes. The smallest is the size of a grain of wheat and was developed first for surgical use: now at war, it signals the bombardier when a death-dealing "egg" is released.

The Pentagon, U. S. War Department building in Washington, used 105,840,000 kilowatt hours of electricity last year, at a cost of $888,244. This outlay of power would supply a city of 100,000 population.

SEAMLESS FLEXIBLE METAL TUBING



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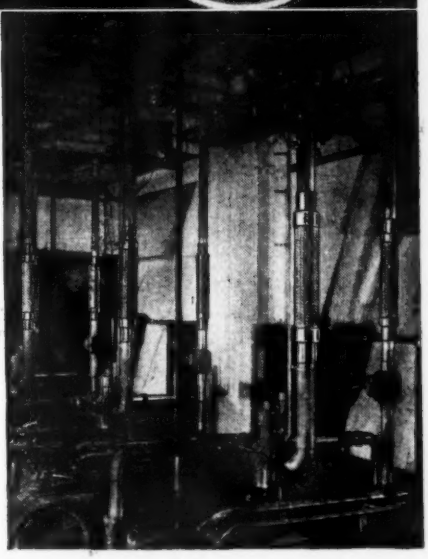

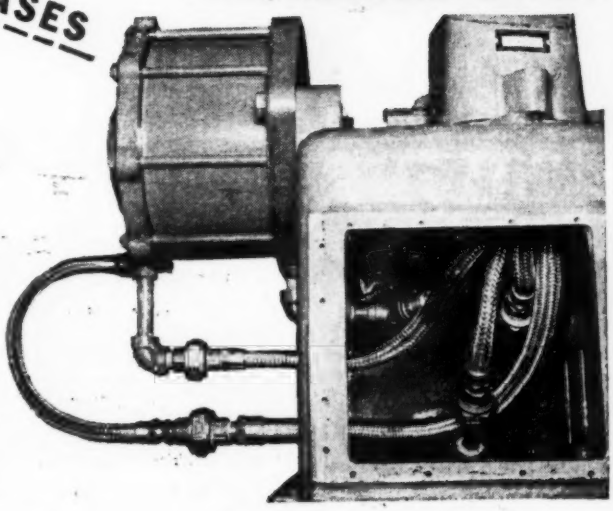

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In literally thousands of industrial applications, American Seamless is solving a multitude of connecting problems where movement of parts, vibration and misalignment of machinery are factors . . . and in conveying gases, liquids and steam under a wide range of temperatures and pressures.

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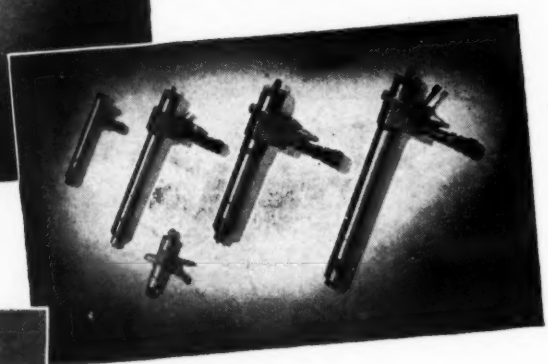

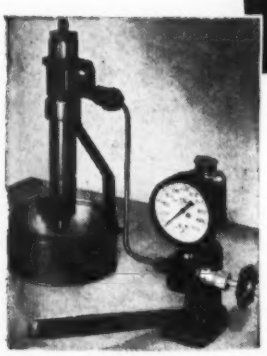

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Readers's Problems

(*Continued from page* 117)

traverse curves for the valve under consideration. By projecting from one to the other, valve movement for various flows can be determined. The valve having the greatest movement for a given flow change will normally give best control. If the greatest amount of close regulation is required below 25% capacity, the V-port valve usually gives best results especially if the fluid handled contains solid particles.

Above 25% capacity even a flat-seated valve can be made to regulate closely with a controller of proper design. If the flow-demand curves are based on accurate and complete data, comparisons at points of greatest regulation indicate the best valve for the service, considering the valve alone.

Having defined the working conditions and selected the valve seat arrangement and valve size, consider valve type in conjunction with the rest of the control system. Type of controller, if an existing unit, may impose limitations requiring special valve treatment. Important factors for the entire control system are: (1) power at the valve stem for a variation in the controlled medium within required limits (2) speed of operation at different valve positions (3) sensitivity of the controller and (4) stability of the controller or freedom from hunting—not to be confused with normal oscillations of certain controllers. Manufacturers can supply complete equipment to meet any control problem, and selection should be made on the basis of their recommendations backed by guarantees.

Materials for valve wearing parts are important. Valves having streamlined plugs and spindles are less subject to wear than other types, but this is largely a question of proper materials for each particular service. Proper use of materials and controller design can offset, to a large extent, special properties of any one valve-port design. Disturbance to upstream pressure may limit the operating speed of a liquid controlling valve if an on-off regulation or rapid changes in flow are required.

If BVN is interested in the technical end of control, paper PRO-58-4 published in the 1936 *ASME Transactions*, pages 291-303, entitled "Automatic Regulators, Their Theory and Application," by E S Smith, Jr, should be of value, also the discussion published in 1937 *Transactions* pages 125-141.

Saint John, N. B. C G CLARK

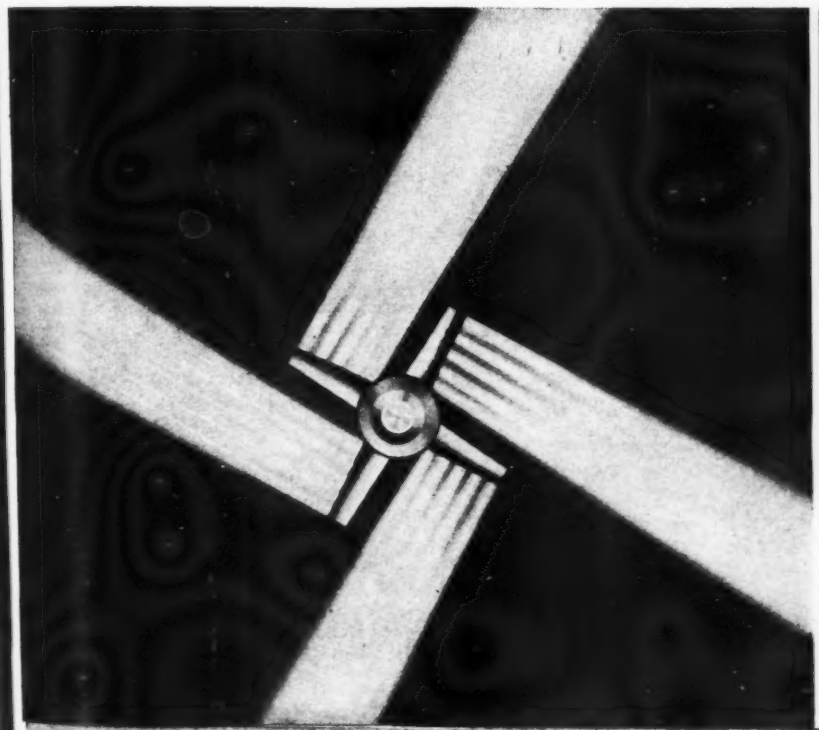
Old Installations or New!

"Pinwheel Action" is the principle of a revolutionary gas burner that uses the energy in gas under pressure to do the work of correctly proportioning gas and air and provide greater heat release.

With the Coppus-Dennis FANMIX Gas Burner, complete combustion with less than 5% excess air is guaranteed! For example, with natural gas of 1,000 B. T. U. per cubic foot, flue gas analysis of over 11% CO_2, a fraction of 1% of O_2, and no CO—is not unusual.

FANMIX gives you truly radiant heat—a high, even furnace temperature. There are no drifting "hot spots"—no secondary combustion to deteriorate furnace lining.

Let us tell you more about increasing ratings with Coppus-Dennis FANMIX. Send for free booklet 410-3.



EXCLUSIVE FANMIX PRINCIPLE

Gas under pressure, escaping from radially-spaced orifices in the driving arms, rotates the fan, causing intake of air at right angles to the path of the gas. The number of orifices, as well as the gas pressure, determines the gas flow. The reaction force determines the speed of rotation, hence the air delivery. Gas and air are thus mechanically mixed — thoroughly and in automatically correct proportions for complete combustion; without impingement.

When planning new boiler installations, you can save on:

1 ***combustion space.*** With FANMIX the furnace does not have to serve as a mixing chamber.

2 ***stack height.*** With FANMIX there is no draft loss across the burner.

3 ***installation costs.*** With FANMIX you can use smaller pipe sizes, you need no forced draft equipment., etc.

ANOTHER **COPPUS** "BLUE RIBBON" PRODUCT

DESIGNED FOR YOUR INDUSTRY— ENGINEERED FOR YOU

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INTESTINES with Fortitude!

PTP

Seamless steel tubes are the intestines of the ship, the power plant, the oil refinery, the locomotive, and the chemical plant...delivering an ever-flowing flood of power to America's mighty production efforts.

Seamless steel tube "know-how" is vitally necessary to keep those lines going steadily. Cold drawn seamless steel PTP tubing achieves accuracy to size and uniformity of gauge through exacting control and thorough inspection at every step in manufacture. Where cost is a factor, and seamless steel tubing required, PTP tubing offers an economical and satisfactory solution to the problem.

★ Heat Exchangers. Photograph courtesy of the Whitlock Manufacturing Company, manufacturers of heat transfer equipment.

PIPE & TUBE PRODUCTS
INCORPORATED
Manufacturers of Cold Drawn Seamless Steel Tubing
JERSEY CITY, N. J. • WORKS: READING, PA.

Engineer's Bookshelf

(*Continued from page* 128)

arcs, how to hold rod and torch or electrode and how to move and advance them over the work. The pictures are clear, the language plain.

DIESEL ENGINE CATALOG (*Vol Nine*, 1944) *Edited by Rex W Wadman. Published by Diesel Engines, Inc, 2 West 45th St, New York 19, N. Y. 466 pp, 10x13½ in., illustrated, spiral binding, fabrikoid cover.* $5.

This volume describes in detail the construction and design features of the diesels built by approximately 50 American manufacturers. Photographs of engines and parts, and sectional drawings, illustrate the descriptions. For each company, a tabular resume lists the various models, giving cycle, horsepower range, cylinder dimensions, number of cylinders, speed, type of injection system, method of starting, and field of application.

An extended section on accessory equipment describes fuel-injection equipment, various types of drives and couplings, superchargers and blowers. In approximately 140 pages of the advertising section, manufacturers of engines and accessories present the features of their products. In the engine part of a directory section, names and addresses of builders are classified by type, speed and size of engines offered; a similar section lists makers of accessory equipment classified by type of product.

This catalog should prove useful to anyone desirous of obtaining, in convenient form, data on diesel engines and accessories currently available.

SEAMLESS TUBE DATA BOOK. *Published by Seamless Steel Tube Institute, Pittsburgh 19, Pa. 320 pp, looseleaf binder, 8½x11.* $2.50.

Most complete collection of data on seamless tubes issued in many years, the book is divided into four sections covering general data, mechanical tubing, pressure tubing and reference tables. Specifications and formulas for pressure piping, metallurgical data, weight tables, special shapes and other useful information are included.

Booklet Reviews

SAFETY THROUGH MANAGEMENT LEADERSHIP *Issued by division of labor standards, U. S. Dept of Labor, Washington 25, D. C. 20 pp.* On request while supply lasts. Aimed primarily at small plants, which can rarely employ trained safety engineers, pamphlet cites actual experience in safety organization for plants of varying sizes. Directed to management the message asks the drive and leadership that it can supply.

ALDRICH HYDRAULIC HANDBOOK *Issued by The Aldrich Pump Co, Allentown, Pa. 60 pp, illus.* Prepared for engineers and others in industry who are concerned with pumps and hydraulic equipment, handbook contains complete and authoritative hydraulic

ANOTHER GREAT ADVANCE IN BELT PERFORMANCE!

—the new COMPASS STEEL CABLE transmission belt for heavy-duty service

NOW comes the greatest step-up in belt efficiency since the introduction of the spectacular Compass Cord belt in 1929 — the new Goodyear Compass Steel Cable Belt.

Built on the same patented principle that made the Compass world-famous for handling industry's heaviest loads, this new belt is sinewed with endless multiple-strand steel cables — in place of cotton cables or cord — embedded in highest quality synthetic rubber and enclosed in a heavy-duty fabric envelope.

This construction gives far greater power capacity than has ever been obtainable in transmission belting heretofore. The new Steel Cable Compass has many times greater strength than the heaviest duty Compass Cord belt. It will handle far heavier loads, withstand much higher tensions, making possible more compact drives, with smaller belts and pulleys.

Beyond this it is the first truly *stretchless* belt — a belt that remains constant in length, free from shrink in storage. Once fitted to a drive, you should seldom, if ever, have to touch the take-up. It is more flexible than any fabric-bodied belt and has a far longer life-expectancy.

Remember, only Goodyear has years of experience in building Compass-type belts. With this Goodyear combines the knowledge gained in developing the first successful steel cable conveyor and V belts — a priceless knowledge that insures tested quality.

If you have a difficult heavy-duty drive—a band-wheel power, compressor, generator or other belt-killer—get full data about this revolutionary new Goodyear development from the G.T.M.—Goodyear Technical Man. Or write Goodyear, Akron 16, Ohio or Los Angeles 54, California.

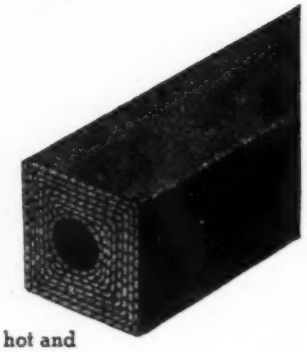
Compass—T. M. The Goodyear Tire & Rubber Company

GOODYEAR INDUSTRIAL RUBBBER PRODUCTS
GTM
-Specified COMPASS STEEL CABLE TRANSMISSION BELT
for Heavy-Duty Drives
The Goodyear Compass Steel Cable belt is bodied with multi-strand airplane-type cable spiralled continuously without a splice. Cable on opposing sides of belt axis is twisted in opposite directions to insure true running.
RIGHT-LAY STEEL CABLE
LEFT-LAY STEEL CABLE
GOODYEAR
THE GREATEST NAME IN RUBBER
A PRODUCT OF GOODYEAR RESEARCH

BUY WAR BONDS—BUY FOR KEEPS

BELMONT PACKINGS

BELMONT 9 . . . For all hydraulic services from low pressures to extremely heavy duty, hot and cold water.



BELMONT 319 . . . For hot and cold water rods and plungers.

FOR WATER

Belmont 319 Hollow Center Packing and Belmont 9 Special Hydraulic Packing will properly seal stuffing boxes of heavy hydraulic units such as presses, accumulators, draw-benches, squeezers and pressure pumps.

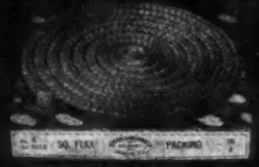
The hollow center of Belmont 319 Packing, provides a point of least resistance for expansion and extraction. Hence, the packing will "breathe" toward the "hole" as varying conditions of service within the stuffing box are exerted upon it.

Belmont 9 combines two distinctive materials made into one integral packing. The channel not only acts as a wiper, but as a protection to the inner body of flax . . . these two packings used in alternate rings make an ideal combination set.

Authorized Belmont distributors are located in every large industrial center to make recommendations on your requirements, or if you desire, a request on your company letterhead will bring a copy of the Belmont Catalog displaying the complete Belmont Packing Line in detail.

THERE'S A BELMONT PACKING FOR EVERY SERVICE

Steam, Water, Oil, Gas, Air, Acids, Alkalies, Ammonia



Rings, Spirals, Coils, Reels, Spools, Sheets, Gaskets.

THE BELMONT PACKING & RUBBER COMPANY
BUTLER AND SEPVIVA STREETS • PHILADELPHIA 37, PA.

information and tables, including the following: water head equivalents, pump plunger loads, hydraulic formulae, plunger displacement, pressure equivalents, capacity of shafts, electrical data, pump discharge diagrams, accumulator volumes, friction losses in fittings and pipes, capacities of pumps and cylinders, barometric pressures pipe data, etc. Many high-pressure triplex and quintuplex pumps, for usual and unusual services in the marine, power, petroleum and other industrial fields are illustrated and described.

WATER RESOURCES PAPER No. 85 By *Dominion water and power bureau, surveys and engineering branch, Dept of Mines and Resources, Ottawa, Canada.* 442 *pp.* $1 *Order from Controller of the Bureau (check or postal note payable to Receiver General of Canada).* Dealing with surface water supply of Canada, this number contains results of investigations by Dominion Hydrometric Survey during climatic years, Oct 1, 1937 to Sept 30, 1939, in Ontario and Quebec provinces. It deals with stream flow data for principal rivers and streams, lists previous publications in series.

A PLAN TO HELP YOU EMPLOY DISABLED VETERANS AND OTHER HANDICAPPED PERSONS PRODUCTIVELY AND SAFELY (1944) *Distributed without charge by American Mutual Alliance, 919 N Michigan Ave, Chicago 11, Ill.* 24 *pp,* 6x9. Pamphlet gives fundamental 5-step plan for employing handicapped persons with safety to themselves and with benefit to all.

Five ASA Booklets

Pub by American Standards Assn, 29 W 39th St, New York 18, N. Y., at prices listed.

THE AMERICAN STANDARDS FOR LIGHTNING ARRESTERS (C6.2.1-1944). 30¢. A revision of standards approved in 1936, this ASA booklet applies to substantially all arresters designed for protection of ac power circuits.

THE AMERICAN STANDARD TERMINAL MARKINGS FOR ELECTRICAL APPARATUS—*4th edition* (C6.1-1944) $1. Under sponsorship of National Electrical Mfrs Assn and approved by ASA, this enlarged edition represents latest efforts of the sponsor and the sectional committee to keep the basic rules for identifying terminals in step with new developments in the electrical industry. Under NEMA leadership, this policy has been followed consistently since the first edition was issued under ASA procedure in 1925.

SAFETY IN ELECTRIC AND GAS WELDING AND CUTTING OPERATIONS (Z49.1-1944) 40¢. A new war Standard concerns electric and gas welding and cutting operations. In handling and operating oxyacetylene apparatus, safe practices are needed because of many inexperienced operators and the great extension of wartime welding and cutting operations.

ASA STANDARDS FOR INDUSTRIAL CONTROL APPARATUS (C19.1-1943) 50¢. Revised ASA Standard for industrial control apparatus in heating, generating and general machin-

Check up ON CHAPMAN'S

NEW LIST 960 GATE VALVE

Designed for still greater strength and longer service, this small forged steel gate valve of the rising outside screw type replaces the standard List 960.

Check these Four Features . . . .

- ✓ Bonnet now fitted with a substantial forged steel yoke. A flanged forged steel packing gland is provided, thereby eliminating exposed threading on valve yoke, thus giving immunity from rusting and corrosion when placed in exposed locations.
- ✓ Stems, plugs, and seat rings *on all valves* are heat treated stainless steel to insure greater working qualities.
- ✓ Swivel bolts are used for holding the packing gland.
- ✓ No gaskets to blow, as in valves with flanged bonnet connections.

Specify List 960 outside screw type in carbon steel for working pressures to 800 lbs. at 750°F. Or in alloy steel for service at 1000 lbs. working pressure at 750°F. Both valves available in screw and welding ends. Where service conditions make it preferable the List 960 rising stem inside screw type is available.

For greater pressures—specify Chapman List 990 which is made with heavier walls and extra strength. Available in sizes up to and including 1½", with either screw or welding end.

The Chapman Valve Mfg. Co., Indian Orchard, Mass.

The Starting Point

In the engineering departments and shops of Associated many hundreds of piping jobs, small as well as large, have had their beginning. All were completed and placed in economical operation—under supervision of Associated's field engineers, if required.

But our interpretation of "the starting point" goes a bit deeper. We consider that a good start, with every minute detail acknowledged and classified, is best assurance, or best insurance, of a successful finish. And we assume this responsibility in every instance.

Finally, and most important, we consider that our original job with each new firm is the starting point, the beginning of a long and pleasant period of friendship—the beginning of increased economies in your industrial piping requirements. We make it that way.

ASSOCIATED PIPING & ENGINEERING CO., Inc.
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ASSOCIATED Progressive PIPING

ery fields correlates information in two important standards of the electrical industry—old AIEE Standard No. 15 and NEMA Industrial Control Standard (1937). New ASA Standard concerns manufacture, test and performance of industrial-control equipment. Representing U. S. standardized practice, it assists in harmonizing practices in industry, promotes production economies and thus benefits users of electric motors and control equipment.

ASA War Standard, Screw Threads of Truncated Whitworth Form (Am Truncated Whitworth Threads) (B1.6-1944), **50¢. This new standard** is intended solely as an emergency measure and not as an addition to the Standards for screw threads already established.

U. S. Bureau of Mines Booklets on Fuels

Technical and Economic Study of Packaged Fuel *Report of Investigations No. 3757 available without charge from Bureau of Mines, Dept. of Interior, Washington 25, D. C.* Publication reveals that thousands of tons of coal particles, which in former years would have been discarded, now are fed to furnaces in neatly wrapped packages resembling a bread loaf.

The following booklets, published by Bureau of Mines, are for sale from Superintendent of Documents, Government Printing Office, Washington 25, D. C., at prices listed:

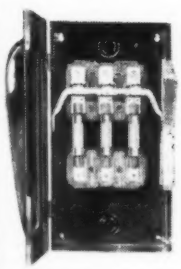
Rare and Uncommon Chemical Elements in Coal *Technical Paper No. 669*, 10¢. In addition to carbon, hydrogen, oxygen, sulphur and other well-known mineral constituents, publication points out that on rare occasions some coals contain uncommon chemical elements, such as gold, silver, platinum, radium, etc. Paper summarizes known information on rare and uncommon elements in coals of this and other countries.

Analyses of Kentucky Coals *Technical Paper No. 652*, 40¢. Report presents facts on composition and quality of coals by individual mines and describes geologic structure of coal-bearing formations, methods of mining and preparation, and production, distribution and uses of coal. Publication contains maps of Kentucky's coal fields and illustrations of geologic conditions and mining procedures.

Analyses of Virginia Coals *Technical Paper No. 656*, 15¢. Publication gives analyses of Virginia coals tested during past 30 years to help wartime consumers of coal find suitable fuel. Report shows that Virginia coals are for general industrial, metallurgical, smithing, domestic, steamship bunkering, railroad fuel and gas- and coke-making purposes.

Lincoln Foundation Papers. All papers submitted in the Jas F Lincoln Arc Welding Foundation's $200,000 Award Program of 1937-38, and the Engineering Undergraduate Award and Scholarship Program of 1942-43, have been placed with Ohio State University's A F Davis Welding Library. J R Stitt, associate professor of welding engineering announced.

Pre-eminent!



Vacu-Break

SAFETY SWITCHES WITH "CLAMPMATIC" CONTACTS

Even if we wished, we could not meet the nation's total demand for Safety Switches . . . But it is gratifying to realize that we are attracting the greater part of the business placed by users who insist on highest quality.

This they get in BullDog with its exclusive Vacu-Break principle of arc suffocation . . . *plus* the Clampmatic feature which assures contacts tight as a bolted connection . . . *plus* stylined cabinets of modern design . . . all at no price penalty! They pay no more but get a lot more!

Capacities from 30 Amp. to 1200 Amp.

BULLDOG

ELECTRIC PRODUCTS COMPANY

BOX 177, R. PK. ANNEX, DETROIT 32, MICHIGAN
In Canada: BullDog Electric Products, Ltd., Toronto
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Buy More War Bonds

Also Manufacturers of

SaftoFuse Panelboards—Switchboards—Circuit Master Breakers—BUStribution Duct, for "plug-in" power—Universal Trol-E-Duct, for flexible lighting—Industrial Trol-E-Duct, for movable "loads."

SCHRAMM COMPRESSORS ARE BALANCED

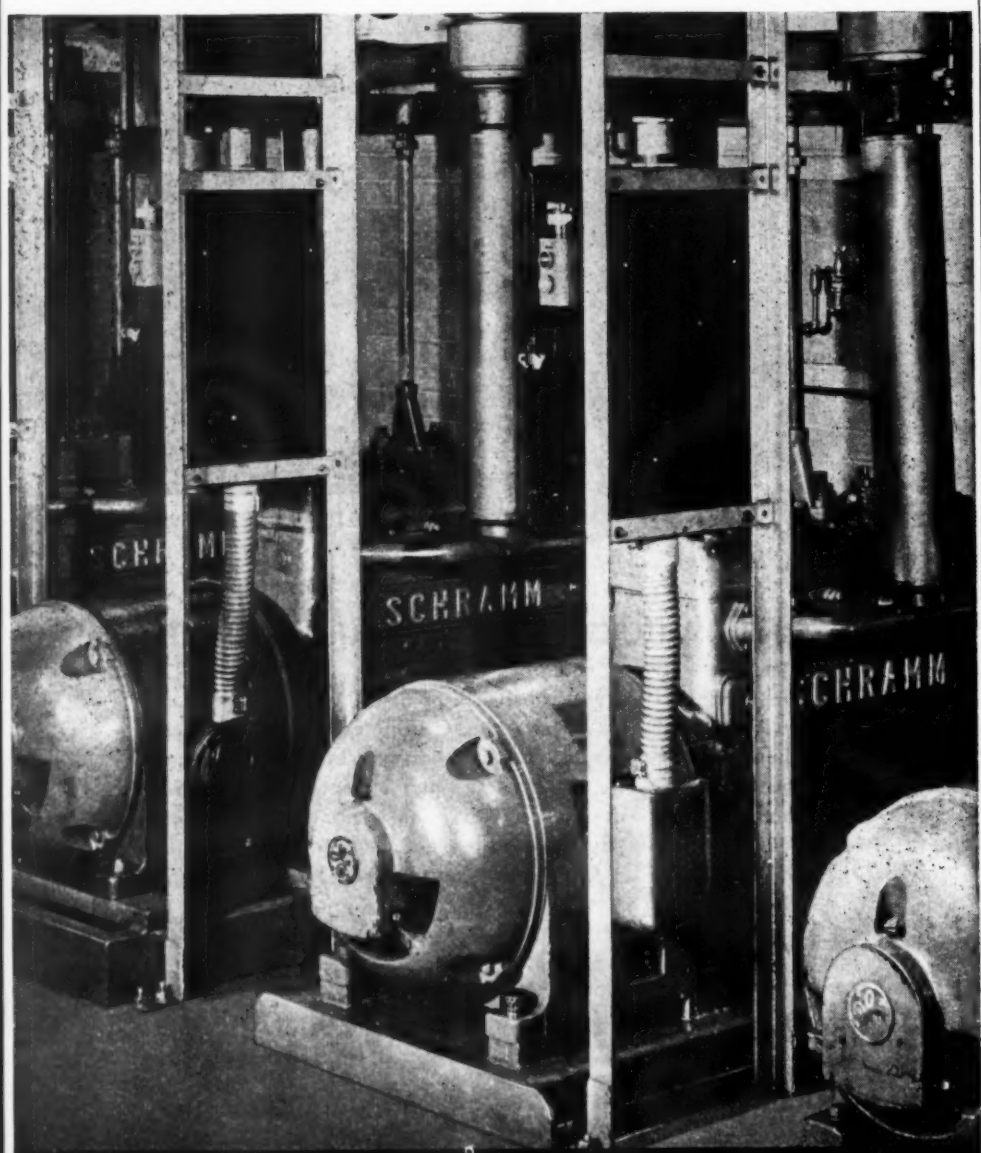
to eliminate vibration

Here's an installation showing just what can be done with an "easy-to-install," compact Schramm air compressor.

The Units represent "Utility" Compressors. Schramm compressors are available with various types belt drives, as well as built-in motor drive and direct connected diesel or gasoline engines. Other features that assure all the air you want include: 1 — completely watercooled. 2 — forced feed lubrication. 3 — mechanical intake valve. 4 — sturdy support for cylinder heads.

Specify Schramm Air Compressors in your plant and get heavy-duty continuous operation with least attention, upkeep and operating costs.

Write for full data in Catalog IND-44.



SCHRAMM INC. THE COMPRESSOR PEOPLE WEST CHESTER PENNSYLVANIA

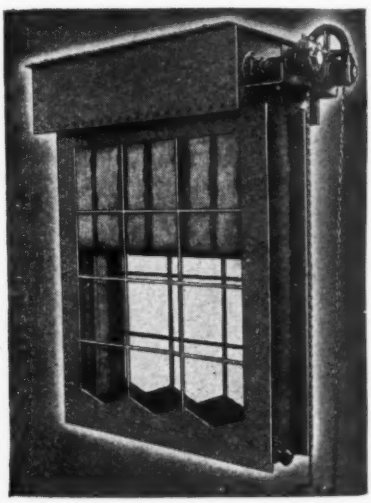
New Equipment

(*Continued from page* 130)

metal is used as the finger that pulls trigger. No appreciable mechanical load is exerted on bimetal as it trips breaker. While primarily designed for military applications, circuit breaker's high-time lag adapts it to protection of motors and other equipment having high-starting surge currents. Range is 5 to 50 amp at 32 v. ac or dc. *Littlefuse Inc,* 4757 *Ravenswood Ave, Chicago* 40, *Ill.*

Reverse-Flow Damper

HEACON DVHR DAMPER has two curtains for regulating gas flow in either direction. Curtains are tied together mechanically so as to operate simultaneously. This permits flow in either direction regardless of damper position. With damper in a natural-draft bypass around fans, or in heat or dust-



regulator equipment, unfavorable conditions normally encountered are said to be eliminated. It provides complete isolation of equipment for maintenance purposes, eliminates recirculation, reduces equipment maintenance. DVHR damper can also be used in crossover air ducts between forced-draft fans. *Thermix Engrg Co, Greenwich, Conn.*

Oil Filters

DR SERIES for bypass installation has a relief valve set to maintain most efficient operating pressure inside clarifier and to allow circulation through clarifier when oil is cold. Flow capacities range from 1 to 20 gpm. Small models are for maximum working pressure of 100 psi and a hydrostatic pressure of 150 psi for small internal-combustion engines requiring shunt installations. For larger engines where bypass installation is preferred, there are DR models with working pressures of 40 psi and hydrostatic test pressures of 60 psi.

DRU series is for lubrication system of diesel, gasoline or natural-gas engines where operating temperatures are too low or pump capacities are inadequate for

What do you want to know about Turbine Oil?

Recently a number of utility plant men were asked, "What do you want to know about turbine oil?" Several of them had very specific questions. They are answered here because they may help you in selecting a turbine oil that solves, once and for all, the ever present problem of turbine oil maintenance. One question is taken up each month, but you can get the answers to all of them now—see the booklet offer.

3. What is an oxidation inhibitor —how does it prevent acidity?

It is easier to prove that an oxidation inhibitor does prevent acidity formation in a turbine oil than it is to tell exactly how and why it works. Short of being able to look into a turbine oil, and to see molecules and to study their reactions—how an oxidation inhibitor operates must be a molecular theory.

It is known that petroleum molecules have an affinity for oxygen. When the molecules of conventional turbine oil unite with oxygen, the products of oxidation include two types—asphaltenes and oil soluble acids. This we know from cold, chemical analysis.

The molecules that form asphaltenes can be removed by refining. But when they are, the acid-formers become more active. They oxidize to form acids by what is called an "autocatalytic" or "chain" reaction. At first only a very few molecules of the oil are affected. These promote the oxidation of other molecules, and so on until the oil is oxidizing rapidly. The function of an inhibitor is to break the "chain" in its earliest stages.

To go from theory to known fact —that the inhibitor in Nonpareil effectively stops acidity formation— the records of many thousands of gallons of oil in hundreds of turbines may be had as proof. These records show that acidity does not increase above 0.15 mg.KOH/gm. and usually remains nearer 0.05 even after ten to fifteen years' service. Of course, that means without special treating or sweetening of the oil to reduce acidity.

Standard Oil gives a *written* guarantee of this performance of Nonpareil for the life of a turbine. What this guarantee means to users of Nonpareil is told in this space next month.

Gasoline Powers the Attack ...
Don't Waste a Drop!

For all the answers send for this booklet... it contains answers to questions such as these:

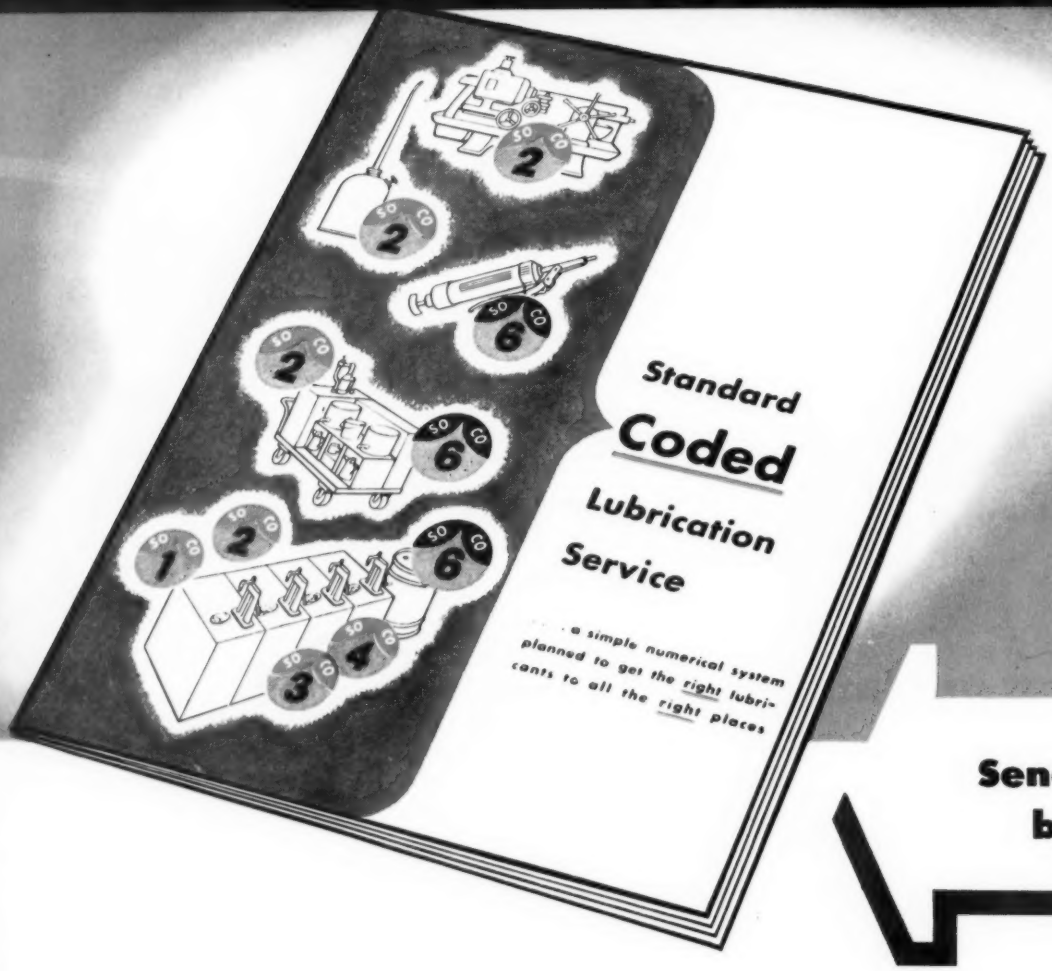
1. What causes turbine oil deposits or sludge?
2. What causes acidity increase in turbine oil?
3. What is an oxidation inhibitor – how does it prevent acidity?
4. How does a guaranteed turbine oil protect the user?
5. Does the inhibitor in Nonpareil Turbine Oil wear out?
6. What causes corrosion in turbines?

Send for a copy of this booklet, or better still, ask for a Standard Lubrication Engineer. He can answer your specific questions about Nonpareil Turbine Oil. Write Standard Oil Company (Indiana), Room 1223, 910 S. Michigan Ave., Chicago 80, Ill., for a copy of the booklet, or the Engineer nearest you.

NONPAREIL TURBINE OIL

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

★ LUBRICATION ENGINEERING



Send for this booklet...

The first, simple system for getting the right lubricant in all the right places

● IT'S AS EASY as 1, 2, 3, to install and follow Standard Coded Lubrication. With it, all lubricants are applied by number. There are no brand names or grade designations for oilers to remember. Here's how easy it is:

The first step is to assign simple numbers (from 1 to 15, or more if necessary) to every lubricant used in your plant. Decalcomanias (paint transfers) are used which are numbered to correspond to the lubricant numbers you have assigned. The decals are applied to:

1. Each spot to be lubricated to indicate what lubricant is needed.
2. Each grease gun, oil can, or other dispenser to indicate the lubricant it contains.
3. Each storage container from which dispensers are filled.

With this system, the newest recruit in your oiler crew can be trusted to get the right lubricant in his grease gun or oil can and apply the right lubricant, where it is needed, by matching the numbers. In addition, machine record cards are available for indicating how often to lubricate, etc., but the simple system of numbering is all that is needed to eliminate most of the lubricant application problems in your plant.

...it fully describes Standard Coded Lubrication Service—its advantages, how it is installed, and how you can get it. Better still, if your plant is located in the 14 states shown on the map below, a Standard Industrial Service Representative will be glad to call on you with samples of the decals and forms. He will discuss installing this system in your plant, or applying it to your present lubrication plan, with men in charge of your lubrication. Phone the

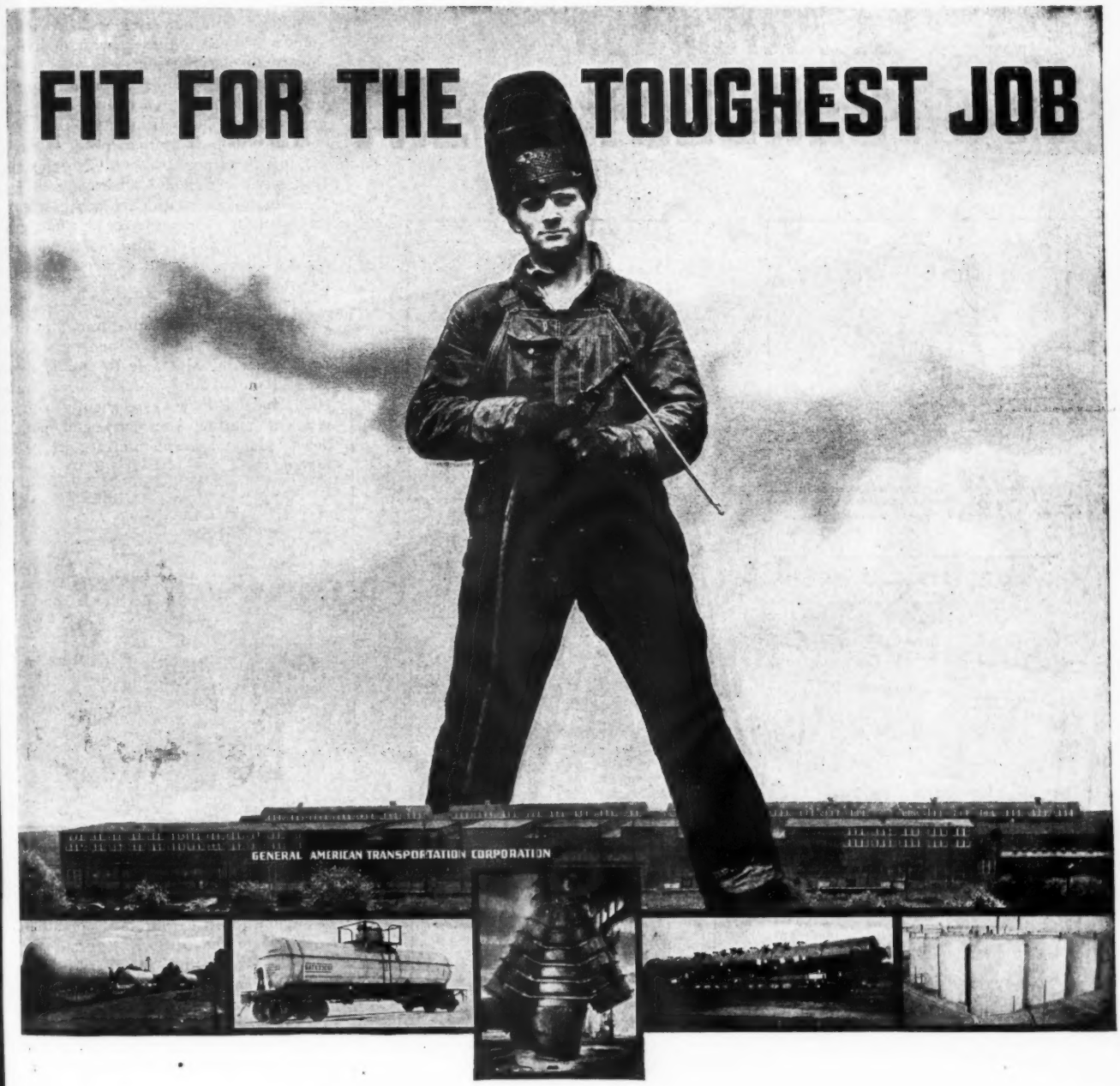
nearest Standard Oil Company (Indiana) office for the Representative, or write 910 South Michigan Avenue, Chicago 80, Illinois, for a copy of the booklet. In Nebraska, write Standard Oil Company of Nebraska at Omaha 2.

Gasoline Powers the Attack...
Don't Waste a Drop!

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

★ LUBRICATION ENGINEERING

FIT FOR THE TOUGHEST JOB



At our Sharon plant, tough jobs are tackled with enthusiasm. If GATX can be said to have a specialty, it is doing the difficult. And doing it by the well-known General American standard: EVERY piece of equipment that leaves our plant is *better than it has to be.* Planned and built and tested to meet *more* than maximum operating demands, GATX products can mean extra safety and extra production economies in *your* plant.

GENERAL AMERICAN TRANSPORTATION CORPORATION

GATX GENERAL AMERICAN PLATE & WELDING DIVISION PLANT AT SHARON, PA.

Plate & Welding Division — Sharon, Pennsylvania

Specialists in plate fabrication—manufacturers of pressure vessels of steel, alloys and aluminum—all classes of welding—process equipment of all types—chemical engineering laboratories and service—completely equipped field erection department.

A Pictograph
OF EFFICIENT DUST DISTRIBUTION

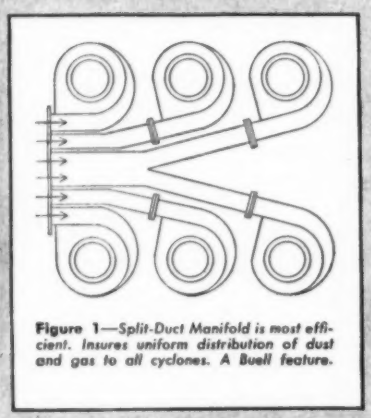


Figure 1—*Split-Duct Manifold is most efficient. Insures uniform distribution of dust and gas to all cyclones. A Buell feature.*

THE MOST EFFICIENT METHOD
(Buell's)

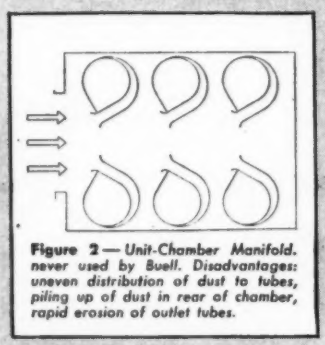
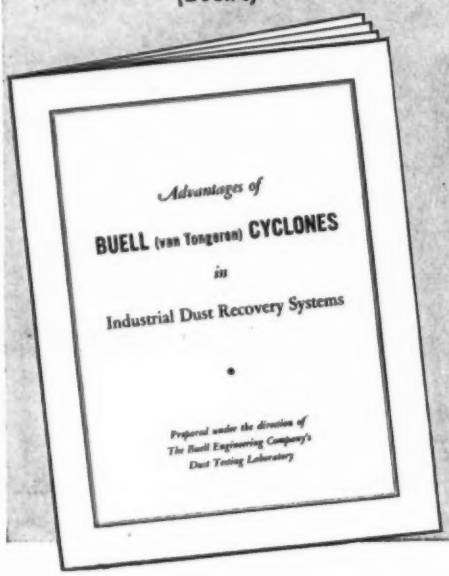


Figure 2—*Unit-Chamber Manifold. never used by Buell. Disadvantages: uneven distribution of dust to tubes, piling up of dust in rear of chamber, rapid erosion of outlet tubes.*

THE LEAST EFFICIENT METHOD
(Never used by Buell)



BOTTOM VIEW OF
MANIFOLD ASSEMBLY

Every engineer and operating executive should have a copy of the bulletin shown above as his guide in the selection of the right dust collection equipment.

buell
DUST RECOVERY SYSTEMS

Buell Design ELIMINATES CLOGGING MINIMIZES EROSION

The scientific development of inlet manifolding for multiple unit cyclone dust collectors has played an all important part in the uniform distribution of both gas and dust in cyclone collectors. How proper manifolding is achieved in Buell Dust Recovery Systems is shown in the pictograph on this page. What happens when the dust load is not uniformly distributed, and how serious these disadvantages may be, is best described in the bulletin shown on this page, from which these two manifold sketches were taken.

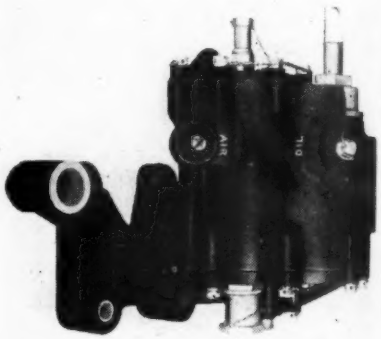
BUELL ENGINEERING COMPANY, INC.
10 Cedar Street, New York 5, N. Y.
Sales Representatives in Principal Cities

DESIGNED TO DO A JOB, NOT JUST TO MEET A "SPEC"

maximum filtration efficiency. Unit has a standard bypass clarifier, with dual rotary positive-displacement pumps and electric heater in base beneath clarifier. Motor and heater interconnect on one electric circuit and overload cutout protects entire circuit. If pumps stop operating, heater is cut off.

G clarifiers are small units for oil filtration service on mobile, marine and light- to medium-duty stationary engines with a minimum flow capacity of 3 gpm. They are supplied with adjustable mounting brackets for direct attachment, usually to side wall of engine.

F fuel-oil clarifiers are for diesel and gasoline engines consuming from 5 to 10 gal per hr. Small compact design makes clarifiers especially adaptable to mobile diesels in field pump units, trucks, buses, cranes, etc. Model F-10 works efficiently with systems of marine, stationary and portable power plants. *Briggs Clarifier Co, Washington, D. C.*



Supercharger Regulators

ECLIPSE TYPE 581 supercharger regulators, Model 12 for updraft carburetors and Model 13 for downdraft carburetors, operate independently of the carburetor throttle, automatically controlling auxiliary stage of two-stage engine supercharger system to produce constant carburetor air-inlet pressure. Bellows resets supercharger regulator, during water injection, to a higher value for war emergency power. Regulator automatically resets to normal when water supply is exhausted or when water injection is discontinued. Low vulnerability and installation ease is by internal oil pressure and oil drain passages. Bellows assembly is submerged in oil, preventing damage from vibration and lubricating all operating mechanisms. *Eclipse-Pioneer div, Bendix Aviation Corp, Teterboro, N. J.*

Steam-Mixer Water Heater

COMPLETE PACKAGED UNIT includes heater, temperature regulator, temperature-pressure relief valve, thermometer and, where necessary, water-pressure regulator and steam- and water-pressure gages. Employing a new muffler-diffuser mixing nozzle, O'Brien heater is efficient and quiet. Not only is all the heat of the steam delivered to water, but condensate itself is utilized as hot water. Unit is for steam pressures of 50 to 150 psi. Steam pipe sizes range from ½ to 1½ in., with capacities ranging up to 5500 gph. There is also a wide selection of temperature ranges, making unit prac-

Test after Test Leads to Year after Year of Dependability

One of many tests of Busch-Sulzer parts. Magnified 62½ times, the image of screw threads is compared with a standard form to prevent errors not visible to the naked eye.

Every part of every Busch-Sulzer Diesel engine is rigidly inspected and tested for strict adherence to specifications before assembly. Then the assembled engine undergoes an operating test for performance standards. Finally, before shipment, the dismantled engine's working parts are given another painstaking inspection.

This testing is but one of the factors that contribute to Busch-Sulzer Diesel engines' reputation for dependability and long life. Other factors are the skill that should be expected of America's first builder of Diesels—plus simplicity of design that results in fewer moving parts, better lubrication and less wear.

Our facilities and trained personnel have been greatly expanded in wartime. When conditions permit, we will go right to work on postwar orders without reconversion delays. Why not acquaint us now with your requirements? We build both marine and stationary engines, both 2-cycle and 4-cycle, with a variety of speeds. An inquiry on your letterhead will receive prompt attention.

BUSCH-SULZER BROS.–DIESEL ENGINE COMPANY
SAINT LOUIS

BUSCH-SULZER
ST. LOUIS

America's Oldest Builder of
DIESEL ENGINES

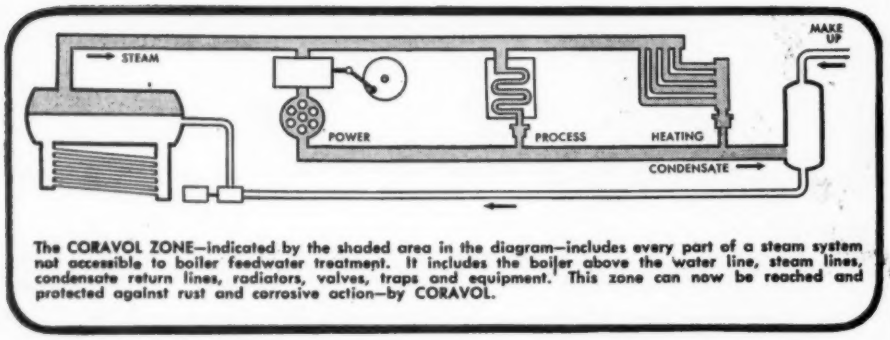
LINES CORAVOL BOILER

WHAT CORAVOL IS NOT!

CORAVOL is *not* a boiler feedwater treatment.

WHAT CORAVOL IS!

CORAVOL is a volatile and condensible liquid treatment for *steam systems.* Only **CORAVOL** (and those products licensed for use under Western Chemical Company's basic patent) completely follows the steam-condensate circuit throughout the *entire* system, by *volatilizing* with the steam, *condensing* with the steam, and *dissolving* in the condensate.



The CORAVOL ZONE—indicated by the shaded area in the diagram—includes every part of a steam system not accessible to boiler feedwater treatment. It includes the boiler above the water line, steam lines, condensate return lines, radiators, valves, traps and equipment. This zone can now be reached and protected against rust and corrosive action—by CORAVOL.

WHAT CORAVOL DOES!

CORAVOL (and only **CORAVOL**) saves you costly pipe repairs, replacements, shutdown loss, and labor, because **CORAVOL** (1) *prevents corrosion* in steam and condensate lines, (2) *cleans out* clogging rust deposits resulting from previous corrosion, thereby (3) *increasing the effectiveness* of heat transfer surfaces; *restoring original capacity* of lines and the operating efficiency of valves and traps.

EASY AND ECONOMICAL TO USE—For 7 years CORAVOL has proved its efficiency in hundreds of heating and steam power plants in more than 20 different industries. Mail the coupon today for complete FREE data on the CORAVOL Process.

MAIL COUPON TODAY

WESTERN CHEMICAL COMPANY
715 Washington Street — Kansas City 6, Missouri

Without obligation to me, please send complete data on the CORAVOL Process

NAME _____ TITLE _____

COMPANY _____

ADDRESS _____

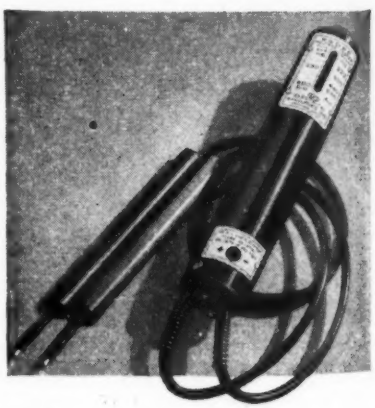
CITY AND STATE _____

tical as either primary or booster heater. Mixer is in close-grained iron. When conditions again permit, body will be cast bronze. *Dept* 53, *O'Brien Steam Specialty Co,* 205 *Harrison St, Syracuse* 2, *N. Y.*

Grease Gun

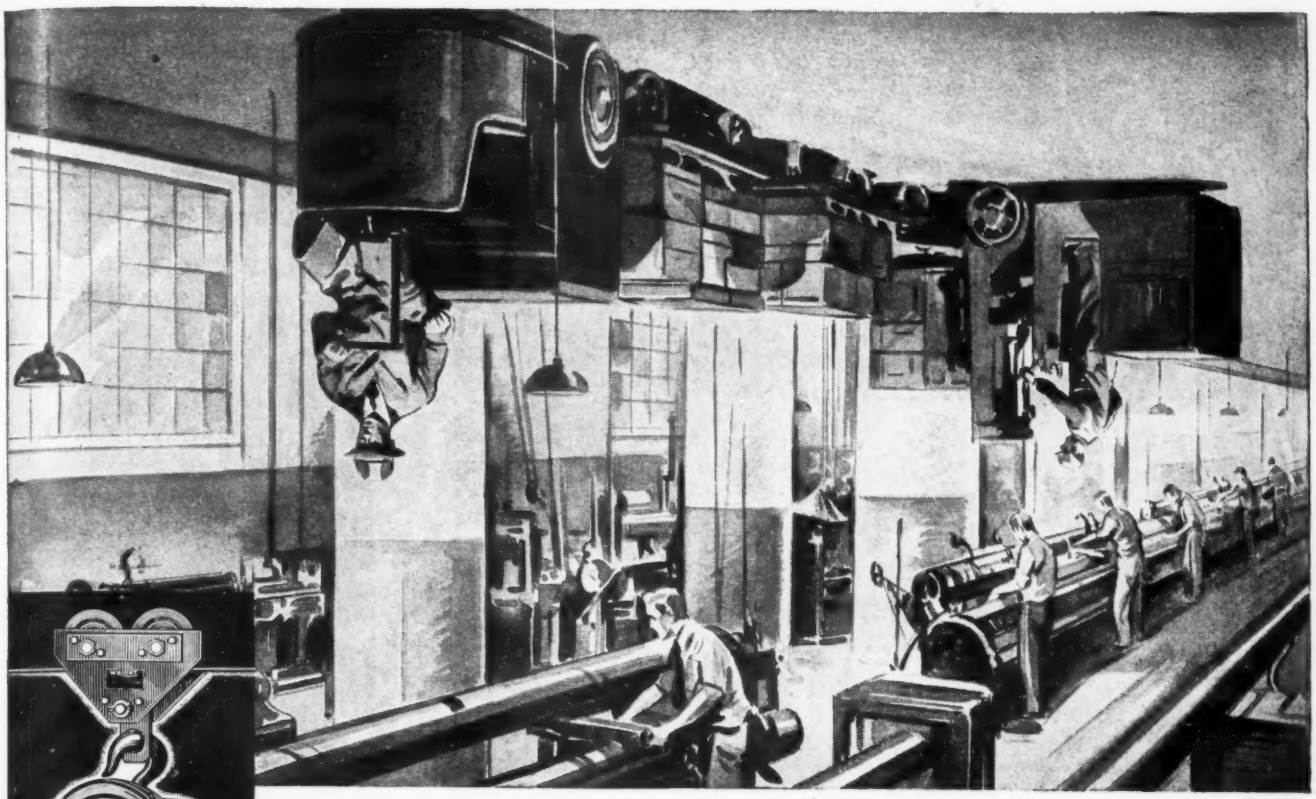
MODEL 7190 ELECTRIC PORTABLE power grease gun is for fast, positive high-pressure lubrication with all lubricants that seek their own level. Equipped with large heavy-duty wheels for easy mobility, operation is further facilitated by a ball-bearing front caster in steering mechanism. Quiet driving device connects heavy-duty ⅓-hp electric motor to high-pressure grease piston

and cylinder. Mercury switch automatically shuts off motor when pressure in delivery hose reaches 5000 psi. Gun has an easily accessible check valve and pressure-release valve. Equipment includes a 12-ft electric cord, 6-ft length of ¼-in. hose with a burst pressure of 20,000 psi, control valve with hydraulic coupling, combination handle, cord and hose rack. *Industrial Alemite div, Stewart-Warner Corp,* 1826 *Diversey Parkway, Chicago, Ill.*



Voltage Testers

NEON-LIGHT polarity indicator in base of Knopp SDP-2 voltage tester shows the polarity of a dc circuit under test and enables one to differentiate readily between ac and rectifier dc current, as well as between ac and pure dc. In addition, light signals presence of potential in daylight or darkness and provides, together with solen-



CAPACITY
¼ TO 40
TONS

Wright

gives the one-story shop two production floors

WRIGHT HOISTS and **CRANES** can make your idle ceiling help speed production. From their long years of accumulated experience, **WRIGHT** engineers can suggest ways to use your overhead space so that a one-story shop virtually has two production floors. **WRIGHT** Improved High Speed Hoists, **WRIGHT** Speedway Electric Hoists, and the famous **WRIGHT** Cranes have long made possible fast, safe, economical transportation of materials. • Your local **WRIGHT** distributor is well qualified to suggest methods for both speeding production and saving money. You will find him listed in your metropolitan classified telephone directory. You can depend upon him. If your problem is special, ask your distributor to call a **WRIGHT** engineer, who has had years of experience in solving all manner of material handling problems.

WRIGHT MANUFACTURING DIVISION
York, Pa., Chicago, Denver, Los Angeles, New York,
Portland, San Francisco

AMERICAN CHAIN & CABLE COMPANY, INC.
BRIDGEPORT • CONNECTICUT

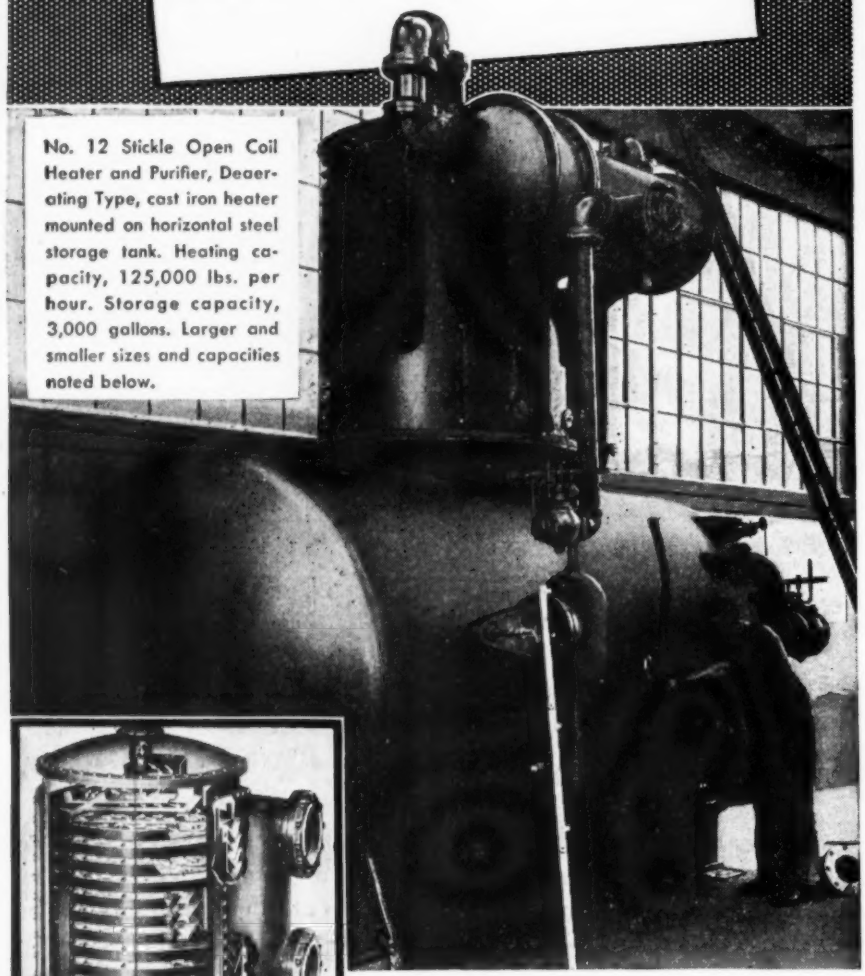
ACCO

ARMY E NAVY
FLYING OVER THE WRIGHT HOIST PLANT

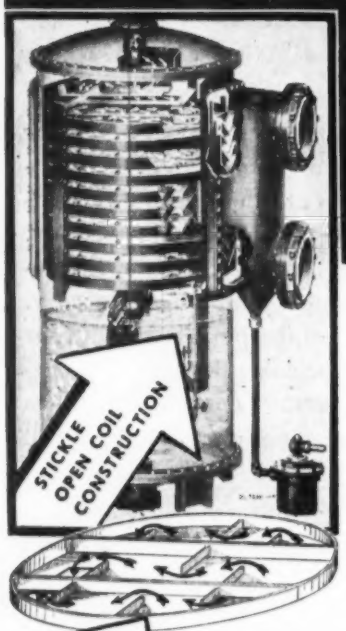
In Business for Your Safety

WRIGHT *Improved High Speed* **HOISTS**

STICKLE
OPEN COIL
FEED WATER HEATERS



No. 12 Stickle Open Coil Heater and Purifier, Deaerating Type, cast iron heater mounted on horizontal steel storage tank. Heating capacity, 125,000 lbs. per hour. Storage capacity, 3,000 gallons. Larger and smaller sizes and capacities noted below.



1 **Heat Water to Higher Temperature in Less Space.** Bring water into direct contact with steam. Instantaneous transmission of heat from steam to water. Delivers feed water to pump within two degrees of temperature of saturated steam in heater.

2 **Supply Better Quality of Feed Water.** All steam condensed in heating feed water becomes part of boiler feed supply. Large portion of total boiler supply absolutely free of scale-forming substance.

3 **Control Admission and Overflow Automatically.**

4 **Perform Indefinitely Without Repairs.** Trays easily removed for cleaning. Water does not overflow sides of trays. Scale-forming substance does not accumulate on side-walls of heaters.

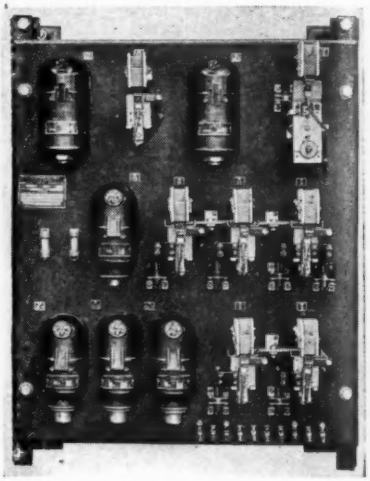
5 **Available in 10 Standard Sizes** in Single Heaters, capacity range, 3,000 lbs. to 130,000 lbs. Dual Heaters in six standard sizes, capacity range, 30,000 lbs. to 250,000 lbs. Deaerating and non-deaerating types.

In private industries and public institutions Stickle Heaters have established during the past 40 years an enviable reputation for efficient, dependable, and long-life service.
Ask for Bulletin No. 117.

STICKLE

STICKLE STEAM SPECIALTIES CO.
2265 VALLEY AVENUE, INDIANAPOLIS, INDIANA

oid indicator, a dual means of detecting voltage. Testers contain a mounting in case top into which one prod may be inserted so that only tester and prod need be handled during tests. Incoming leads are physically separated from each other within case for added safety in testing heavy power circuits. Junior model SDP tester does not have the neon polarity feature. *Electrical Facilities, Inc, 4240 Holden St, Oakland 8, Calif.*

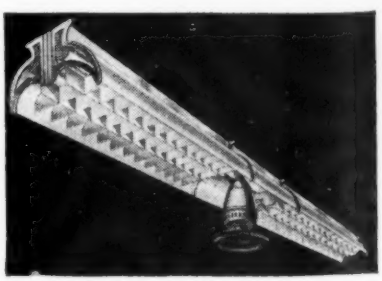


Floor-Operated Controllers

CONTROLLER PANELS, with resistors for separate mounting, are compact for mounting on crane girders and meet minimum collector-bar requirements. Hoist panels (as shown) are of dynamic lowering design for cranes without mechanical load brakes and of reversing for cranes with mechanical load brakes. Trolley and bridge panels are of reversing plugging design.

Main hoist has overload-relays and low-voltage protection features. Panels for other motions on crane obtain overload and low-voltage protection from main hoist panel. This arrangement not only simplifies panel for these motions and standardizes them for a wide range of hp sizes, but also reduces number of collector bars required on crane.

All panels are of tilting design for easy access to rear of panel wiring, power connections, etc. Control circuit terminals are front connected. Cabinets, with provisions for padlock, are either general purpose or gasketed type. *Electric Controller & Mfg Co, Cleveland, Ohio.*



Fluorescent Fixture

RELAXATION OF WEIGHT limitations by WPB has made possible the return of Futurliter, the fluorescent luminaire for continuous-flow illumination. Fixture is for 2 and 3 rows of 40-watt lamps and can be mounted directly or suspended from ceiling. Futur-

What Does It Take To Build Great Motors?

1 FOR ONE THING, it takes a lot of *quality* men like Bill Seebode, 50 year man at A-C. There's no machine known that can assemble the maze of wiring and insulation that goes into a stator with Bill's skill and care ... or that can fully test how *well* he's done his job. There's only one test ... wait 5, 10, 15 years and *see*. And that's the test that has proved over the years, Allis-Chalmers motors are *great* motors!

2 HUNDREDS OF A-C MEN, proud that they have won and are *keeping* the confidence of engineers and operating men throughout American industry, have a *personal* stake in every motor they build for you. That's one reason why Stan Brothers follows his job so intently ... as he painstakingly polishes a shaft down to a finish slicker than silk, getting rid of every irregularity that could someday invite failure.

3 TO WATCH HIM OPERATE, you'd think Walter Conner was conducting a one-man scrap drive. Not that he finds many defective motor shafts in the course of a day's inspection — but he sure *looks* for them. And when he finds one — bang — it lands on a scrap pile. In a way, we feel it's the group of motors we *didn't* build that's behind the reputation: "You can *depend* on Allis-Chalmers Motors!"

4 NO—THAT'S NOT A SICK MOTOR. Actually it's a very *healthy* one. But that's something we must know, through generous sample testing, about every motor before it can tackle a job for you. Part of the "physical exam" McGarvey Eddleman is giving this motor is the heat-run test ... checking speed and temperature hourly while motor runs at full load. It's just one precaution that helps A-C build consistently great motors.

5 YES, MEN MAKE MOTORS! Men like Sam Meister, for example. The machine doesn't exist that can duplicate his skill. With an acetylene torch in one hand, a silver alloy rod in the other, Sam silver-brazes the end connections on famous Allis-Chalmers rotors. Round and round the connections he works — expertly flowing in molten alloy to form a joined structure that can withstand as much heat as though it were a single die-casting.

IF YOU COULD MEET and talk with the men who build Allis-Chalmers motors, you might be surprised to learn how keenly they are aware of the big *personal* stake they have in every motor they build for you.

They know that factory tests to fully pre-determine how well a motor is built *just don't exist;* that there's still no substitute for responsible craftsmanship.

And they know that when they build *great* motors for you they're making *friends* — and that friends are something no company and its workers can have too many of.

Next time you need the kind of extra-quality (but not extra-price) motors Allis-Chalmers builds, check with our nearby district office. Or write direct to ALLIS-CHALMERS, MILWAUKEE 1, WIS.
A 1774

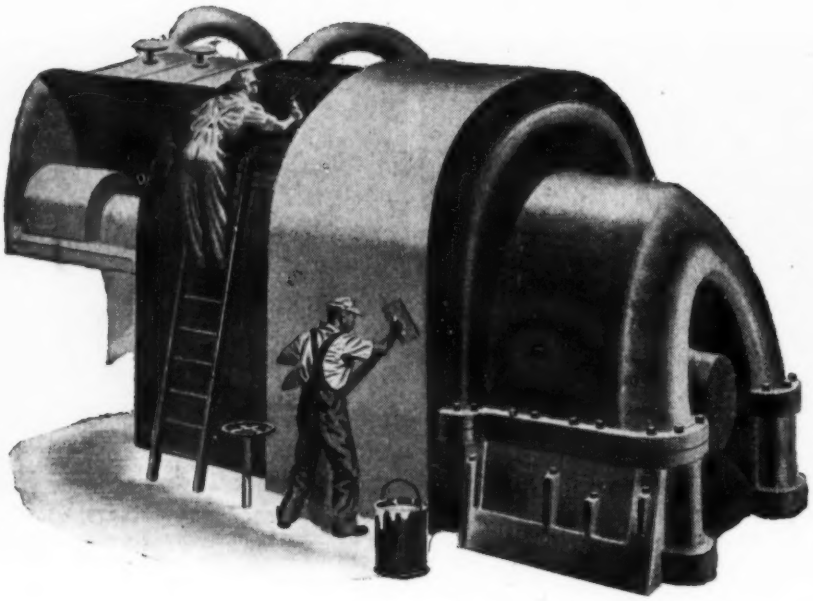
♪ *Tune in the Boston Symphony, Blue Network, Saturday at 8:30 pm, EWT.*

YOU CAN DEPEND ON ALLIS-CHALMERS MOTORS

Greater Fuel Economy with

B-H BLACK ROCKWOOL

INDUSTRIAL INSULATIONS



For long, trouble-free service, and exceptionally low thermal conductivity, you can't beat B-H *black* rockwool. It is physically and chemically stable, which means it will stand up under extreme service conditions. It is moisture-resistant and that means a permanence of physical properties and retention of high insulating value under humid conditions that many other insulations cannot withstand.

B-H insulating products made from black rockwool are designed to meet specific requirements for labor-saving and efficient application. Available in the form of high- or low-temperature blocks, blankets, felts, and insulating cements.

Whatever your insulating problem, it will pay you to consult Baldwin-Hill. B-H insulations can help you do a better job—more economically.

Baldwin-Hill Co., 1545 Klagg Ave., Trenton 2, New Jersey. Plants in Trenton, N. J., Kalamazoo, Mich., and Huntington, Ind.

A Product for Every Service

MONO-BLOCK—
effective up to 1700°F

BLANKETS—
effective up to 1200°F

PIPE COVERING—
effective up to 1200°F

INSULATING CEMENT—
effective up to 1800°F

FELTS—
from sub-zero to 800°F

KOLDBOARD—
effective from—150° to 300°F

SOUNDLINER • FILL • WEATHERSEAL • BOND-TITE • ASBESTOS CEMENT
DIATOMACEOUS EARTH PRODUCTS

Baldwin-Hill

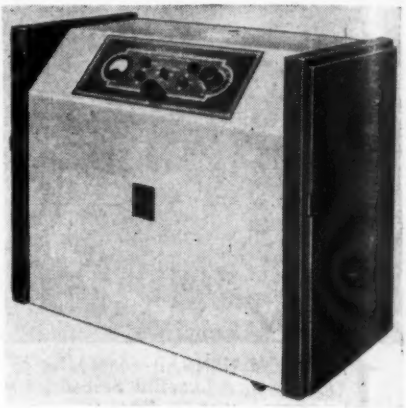
BH COMPANY

HEAT & COLD INSULATIONS

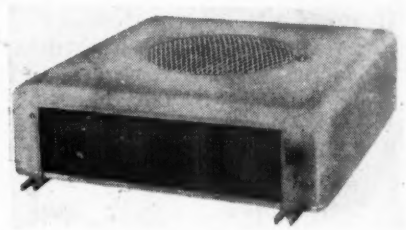
liter is available with cooling sections (See photo, p 162.), with air-disinfection sections (for germicidal lamps), and with color-improving sections (with filament lamps). *Edwin F Guth Co, 2615 Washington Ave, St. Louis 3, Mo.*

High-Frequency Generators

COMPLETELY SELF-CONTAINED, 1- to 20-kw capacity high-frequency generators for both induction and dielectric loads require only electrical connection to a 60-cycle power supply and have no external cooling or other auxiliaries. Units of 50- to 200-kw



capacity can be supplied in addition to standard. Primary voltage is 220 or 440 v, single phase for ratings of 5 kw or lower and 3 phase for 10 kw and higher. Standardized generators have air-cooled tubes. Generators are available for frequencies of 450 kilocycles, 5, 15 and 30 megacycles for ratings through 10 kw and 450 kc, 2 and 10 mc for 20 kw and higher. *Westinghouse Electric & Mfg Co, E Pittsburgh, Pa.*



Ceiling Air Coolers

SPASAVER horizontal air coolers, in white enamel cabinets, are for all refrigerants. Equipped with new propeller fans, units operate with practically no noise. Coils are of fin and tube design, equipped with D & H kinetic refrigerant distributor. Motors are slow-speed totally inclosed ball bearing, 115 v, single phase, 60 cycle, requiring no lubrication after leaving factory. Models come in ten sizes for a wide variety of installations. *Drayer-Hanson, Inc, 738 E Pico St, Los Angeles 21, Calif.*

High-Heat-Resisting Paint

TRIPLE-A HIGH-HEAT-RESISTING paint is shipped in proper consistency for application. For normal interior conditions it is ready for service after application and air-drying. For extremely wet interior, heat

Have You Seen It?

THIS new postwar, general purpose Fairbanks-Morse Motor is available to industry now.

Never before have there been more stamina—more protection—more versatility—built into a motor housing.

You'll have to see it demonstrated to appreciate fully how much this motor can really offer you.

BUY WAR BONDS

Look at These Features!

- ★ It is a 40°C. motor.
- ★ It is a protected motor.
- ★ It has an optional conduit box assembly.
- ★ It has cross-flow ventilation.
- ★ It has ball bearings—sealed-in and protected.
- ★ It has the exclusive Fairbanks-Morse COPPERSPUN ROTOR.

Write for detailed information. Fairbanks, Morse & Co., Fairbanks-Morse Building, Chicago 5, Illinois.

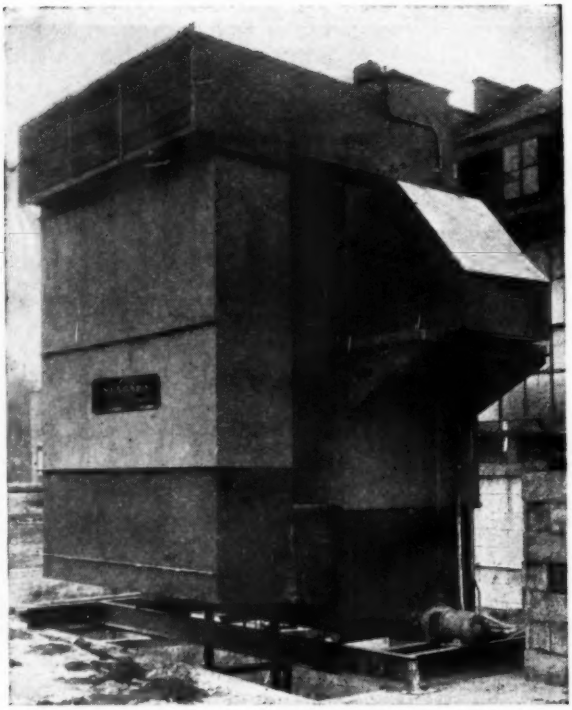
FAIRBANKS-MORSE

DIESEL ENGINES
PUMPS
MOTORS
GENERATORS
WATER SYSTEMS
SCALES
STOKERS
FARM EQUIPMENT
RAILROAD EQUIPMENT

Motors

"BALANCED WET BULB" TEMPERATURE CONTROL

U. S. Patent Re-issue No. 22,533



Don't PURCHASE COOLING WATER!

● Whenever a process calls for the use of water to cool liquids or gases, investigate using the NIAGARA Aero HEAT EXCHANGER to gain these benefits:

1. Year 'round operation at full efficiency.
2. Reliable temperature control within 2°F.
3. Elimination of water treatment.
4. Saving 95% of water consumption.
5. Avoiding risk of shutdown in time of water shortage.
6. Saving piping, pumping and power and equipment costs.

The NIAGARA Aero HEAT EXCHANGER, using outdoor air as the cooling medium with the evaporative method, removes 1,000 B. T. U. from a liquid for each pound of water evaporated. Accurate temperature control within 2°F. is assured by the Niagara patented "Balanced Wet Bulb" control which always provides the correct admixture of fresh and recirculated air. Hundreds of industrial plants, operating a wide variety of processes, have found it the most reliable, most compact and economical apparatus for liquid cooling. Write for Bulletin 96.

NIAGARA BLOWER COMPANY

Over 30 Years of Service in Industrial Air Engineering

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Field Engineering Offices in Principal Cities

INDUSTRIAL COOLING HEATING • DRYING

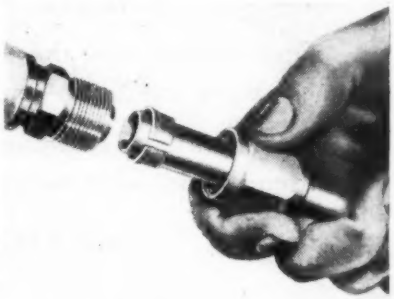
NIAGARA

HUMIDIFYING • AIR ENGINEERING EQUIPMENT

paint to 300 F or over after applying to surface. Paint may be sprayed on hot surfaces where a shutdown is inconvenient. For exterior use, heat paint to 500 F after applying to a metal surface. No heat treatment is necessary for continuously hot surfaces. When heat treated, it resists water, oil, gasoline, benzol, heat and weather. Heat resistance depends on surface to which it is applied. It is noninflammable, nonirritating, and does not give off fumes or odors when applied, upon drying, or when subjected to heat or flames. *Quigley Co, 527 Fifth Ave, New York 17, N. Y.*

Diesel Air Filter

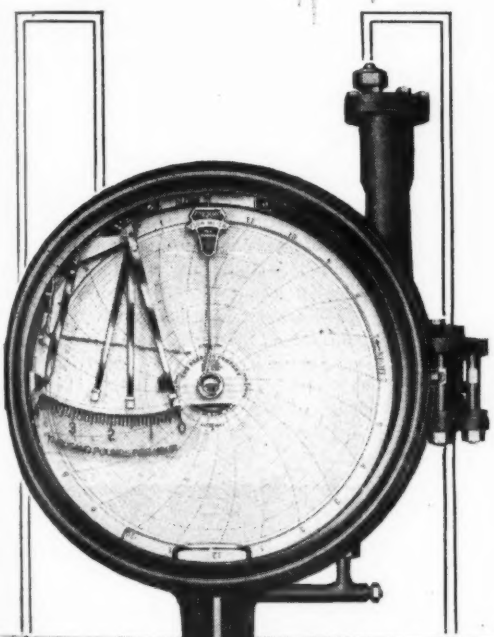
ENTIRELY NEW IN DESIGN, weighing 46½ lbs and with a 2200- to 3200-cfm capacity, *Farr-Air* diesel air filter for diesel engine intakes is complete, ready for attachment. It is composed of four separate filter panels of herringbone-channeled fine wire screen. They are mounted with spring clips on a steel frame for easy removal for cleaning or changing while unit is in normal operation. Filter size is 8¾x22x2⅛ in. Other sizes or capacities may be furnished. *Farr Co, 2615 Southwest Dr, Los Angeles 43, Calif.*



Self-Flaring Coupling

FOR FLEXIBLE PLASTIC TUBING, coupling requires no flaring tools. Flare is formed as coupling members are screwed together in one simple operation, which is said to assure uniform walled flare, with no thinning toward end to weaken tube. Plastic tubing is not preheated. Coupling construction, by providing a union effect, eliminates twisting and distortion of tubing in installation,

Better METERING for Any Fluid - -

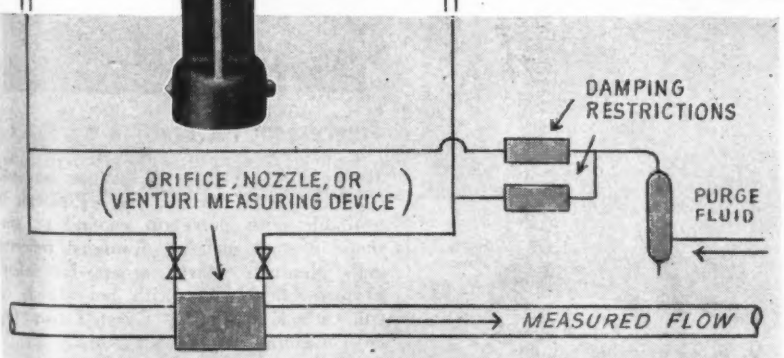


No matter what industrial fluid you meter, chances are that Foxboro Measurement Engineering has met and mastered all its problems.

Foxboro engineers have contributed many of the first practical solutions to industry's tough metering problems. Original Foxboro developments, such as broadened use of the fluid purge principle, have introduced successful measurement of flow where corrosion, contamination, high viscosity or low velocity formerly was a baffling factor. And Foxboro's exclusive advances in meter design have set new standards of accuracy in meter performance.

Even for your simple installations, it costs no more to get Foxboro Meters backed by this broad engineering experience. Write for detailed Bulletin 200-6. The Foxboro Company, 68 Neponset Ave., Foxboro, Mass., U. S. A. Branches in principal cities.

VISIT FOXBORO BOOTH NO. 613 AT THE POWER SHOW



Schematic diagram of Foxboro System for maintaining outward flow from the meter piping, through use of neutral purge fluid. Dirty or corrosive fluids cannot come in contact with the meter!

ENGINEERED ADVANCES found only in Foxboro Meters

- **Extra-Large Float with long travel for extra power.**
- **Float in high-pressure chamber automatically minimizes temperature errors.**
- **Sure-Seal Check Valves positively prevent mercury losses.**
- **Pressure-Tite Bearing eliminates stuffing box and packing.**

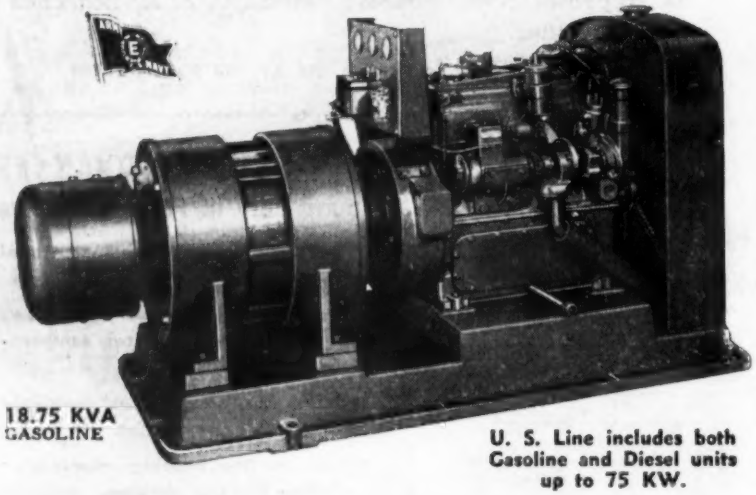
FOXBORO
REG. U. S. PAT. OFF.

DIFFERENTIAL FLOW METERS

SUPPOSE
YOUR SOURCE OF
ELECTRICITY
FAILED
THIS MINUTE
?

Would an automatic emergency unit take over? Or would you just suffer your losses? The safest and best insurance against any such losses is a U. S. Stand-By unit. One failure might easily pay for the entire installation. Available now on AA3 priority or better. Write.

UNITED STATES MOTORS CORP.
552 NEBRASKA STREET • OSHKOSH, WIS.



18.75 KVA
GASOLINE

U. S. Line includes both Gasoline and Diesel units up to 75 KW.

U.S. Electric Plants
FOR STAND-BY SERVICE

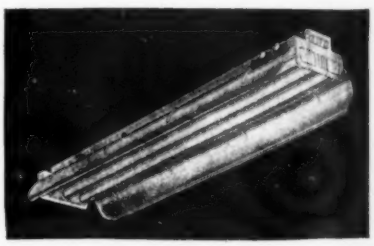
as well as split ends. Only simple shop tools are required and assembly may be made at job. Coupling, for tube sizes ¼- to ½-in. OD, may be reused indefinitely. *Packless Metal Products Corp, 31 Winthrop Ave, New Rochelle, N. Y.*

Slide Rule

INCLUDING NOVEL DECIMAL-POINT locator, slide rule arrangement gives 30-in. accuracy for cube root, 20-in. accuracy for square root. One setting of hairline enables computer to read square root, cube root and logarithm; also determines the decimal point for square root and cube root. Decimal point locator and slide rule, of Sorex tag lithographed, varnished and bonded, is 11-in. long, 2-in. wide, ⅛-in. thick. Instrument manual gives full directions. *Pickett & Eckel, 53 W Jackson Blvd, Chicago, Ill.*

Expansion Fitting

SHORTER AND MORE COMPACT than previous designs, according to manufacturer, expansion fitting requires fewer parts and is therefore easy to install. Standard finish is cadmium plated, but it can also be furnished in bronze. Fitting compensates for expansion and contraction in conduit line. Head, sealed by a special packing, keeps out water or moisture and is ideal where long lines of conduit must be installed. *O Z Electrical Mfg Co, 262 Bond St, Brooklyn, New York.*



Fluorescent Fixture

HEAVY-GAGE STEEL MAZE-LITE is for 2-40 3-40 and 2-100 watt lamps. Reflector is available with porcelain enamel or synthetic enamel surface. Rounded reflector ends eliminate sharp corners for safety. Fixture can be had with hot-cathode or cold-cathode auxiliaries. *Edwin F Guth Co, 2615 Washington Ave, St. Louis 3, Mo.*

Heating Torch

STYLE 9802 MEDIUM-WEIGHT heating torch is for bending, straightening and shrinking of steel plate, as well as for silver brazing of heavy copper plate in manufacture of copper pipe. Torch is said to be of lighter weight than former models, yet has equal gas capacity. Five new multiflame acetylene heating tips and two multiflame propane heating tips serve for all heavy

EXAMPLE OF *Service*:

Adiabatic and Isothermal Compression (page 9) . . . Moisture and Dew Point (page 30) . . . Cylinder Clearance (page 10) . . . Sludge Formations (page 34) . . . These are just a few of the important subjects discussed in our handsome new booklet, AIR COMPRESSOR LUBRICATION.

Clearly illustrated, packed with helpful information, it's free to air compressor owners and their personnel.

Simply write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

More and more, it's service that counts . . .

and *Cities Service* means *good service*!

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CITIES SERVICE OIL COMPANY

ARKANSAS FUEL OIL COMPANY

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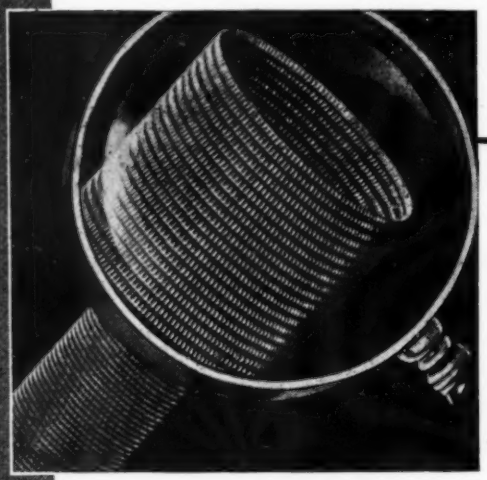
Rust · Scale · Dirt

FROM CLOGGING
STEAM EQUIPMENT



YARWAY

STRAINERS

"The Screen's the Thing"

- *A High Grade Monel Woven Wire Basket* with mesh fine enough to catch the dirt—yet ample free area for passage of clean condensate, oil and other fluids.
- *Body Cadmium Plated Inside and Out for Protection Against Corrosion.*
- *Readily Removed Steel Blow-Off Bushing.*
- *Bushing Automatically Aligns Screen.*
- *Thousands in Use—Sold by Over 100 Mill Supply Houses.*
- *6 Sizes ½" to 2" for Pressures up to 600 Lbs.*

See Your Supply House or write for Bulletin S-200

YARNALL-WARING COMPANY

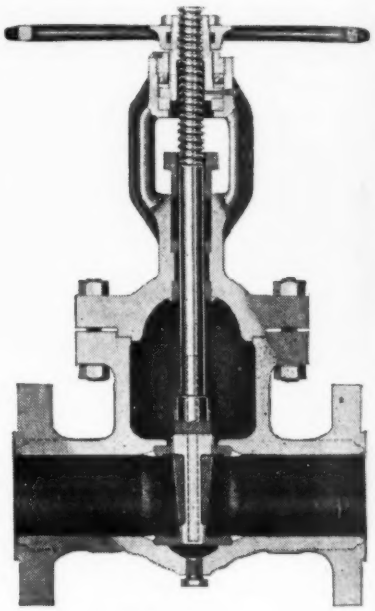
100 MERMAID AVENUE PHILADELPHIA 18, PA.

YARWAY STRAINERS

heating jobs. Three mixers are obtainable for positive-pressure acetylene, low-pressure acetylene and for propane. A 12-in. straight extension and 18- 24- and 42-in. angular extensions are available. *Air Reduction Sales Co, 60 E 42nd St, New York, N. Y.*

Torque Wrench

STURTEVANT SENSORY torque wrench embodies *sound* and *feel* features, as well as visual reading to determine applied torque. Trigger finger can be set at any desired signaling point. As torque is applied with wrench, sensory action sounds a loud click and imparts a strong impulse to the hand when *set* torque is reached. Operator is conscious that release point is reached through three channels instead of just one. *P A Sturtevant Co, Addison, Ill.*



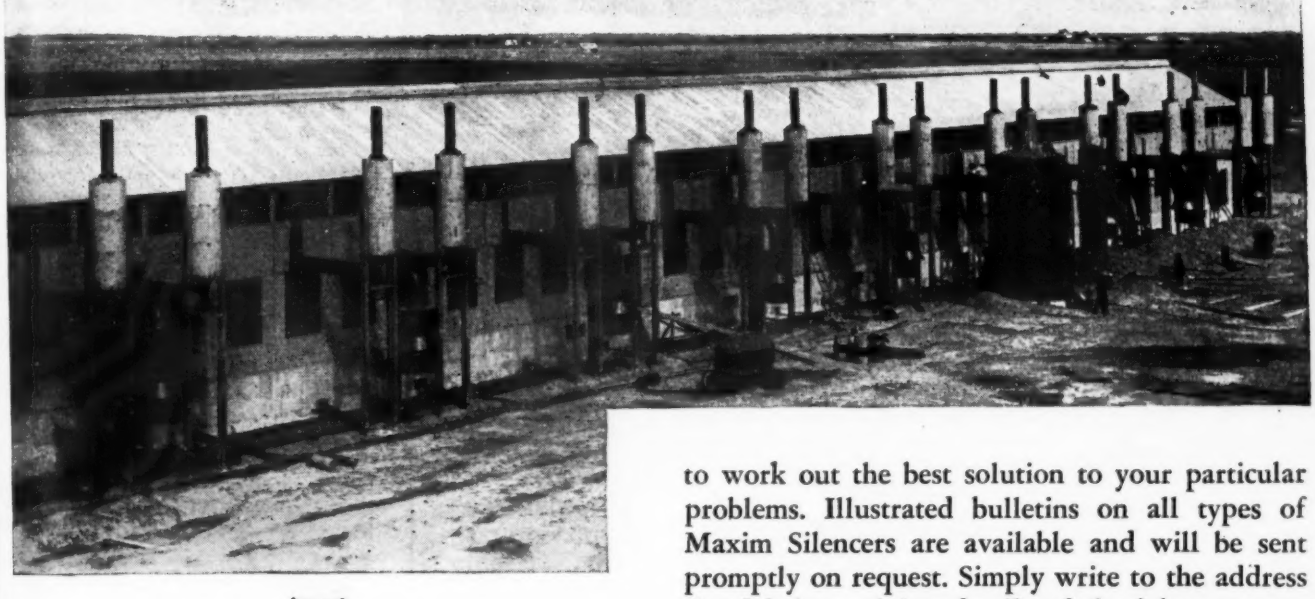
Steel Gate Valves

FOR PERFECT ALIGNMENT of all working parts, close-fitting wedge guide ribs are constructed by a new method which eliminates drag across seating faces. Seat rings are hard surfaced and welded integrally to body. Specially built fixtures permit hydrostatic test of both seating faces simultaneously, in contrast with customary procedure of testing one face at a time. Edward gate valves 4 in. and larger are ball-bearing equipped. In smaller sizes, bearing plates for yoke bushings are *EValized* to reduce operating effort. Cast-steel gate valves are in 2½- to 12-in. sizes for 300, 600, 900 and 1500 psi. *Edward Valve & Mfg Co, East Chicago, Ind.*

Time Switch

PARACON 700 SERIES time switch is for timing automatic heat, ventilating, lighting, pumping or flushing operations. Switches have 6-in. calendar dials which make one complete revolution every seven days. Dial trippers can be independently set for different daily *on* and *off* schedules. Settings can be made in advance for entire week. Any day or days operations may be omitted

MAXIM SILENCERS ON ALL COMPRESSOR STATIONS OF LONGEST GAS PIPE LINE SINCE 1932



The longest gas pipe line since 1932, built by Tennessee Gas and Transmission Co., extends from Corpus Christi, Texas to Cornwall Station, West Virginia, a distance of 1265 miles.

Along the line seven compressor stations maintain the pressure in the 24-inch pipe which is designed for an operating pressure of 750 pounds. All of these stations are completely equipped with Maxim Silencers as shown above on the Bernard, Texas, station.

Wherever there is need for silencing, on engine exhaust, compressor intake, blowers, steam or air discharge, Maxims can be counted on to give long, trouble free service. Maxim engineers will be glad to work out the best solution to your particular problems. Illustrated bulletins on all types of Maxim Silencers are available and will be sent promptly on request. Simply write to the address listed below, giving details of the job you want to do.

* * * * *

A new development, Maxim Heat Recovery Silencers, provide in addition to silencing, the recovery of waste exhaust heat to produce steam or hot water for heating or processing operations. Heat Recovery Silencers are described in Maxim Bulletins WH-100, WH-101, WH-102 and WH-103.

ARMY E NAVY

THE MAXIM SILENCER COMPANY
92 Homestead Ave., Hartford, Conn.

MAXIM

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FAR SHORTER BY THE CLOCK—one mile is 20 seconds in the air!

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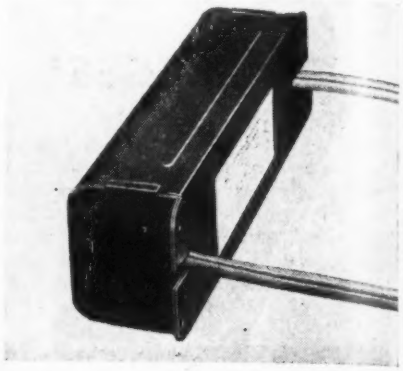
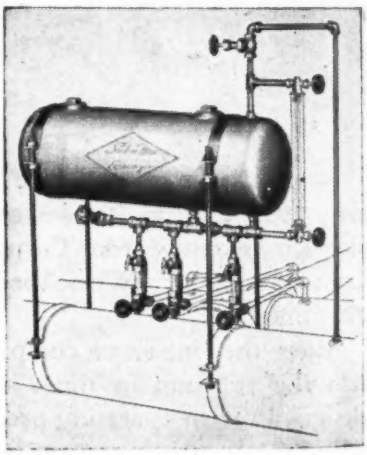
entirely on a preset program. Each day clearly separated from other days and graduated into hours and half hours. Day and night are also distinctly separated. *Paragon Electric Co, 39 W Van Buren St, Chicago 5, Ill.*



Two-Way-Lead Ballasts

FOR OPERATION of Mazda F lamps, two-way-lead ballasts are in the following ratings: Tulamp 30- and 40-watt, standard cross-section; Tulamp 40-watt, high voltage; Tulamp 100-watt; Three-lamp 40-watt; and Forlamp 100-watt. With leads that can be brought out at either the ends or bottom of ballast cases, ballasts are interchangeable with and serve same applications as both the superseded leads-out-the-end and leads-out-the-bottom ballasts of the same ratings. For exposed or inclosed mounting. *General Electric Co, Schenectady 5, N. Y.*

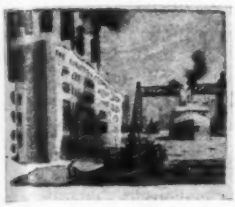


Chemical Feeder

UNIT, CONSISTING OF a 10-gal tank with drip valves for connection to steam headers, feeds alkaline solution into heating systems to neutralize CO_2 and thus prevent corrosion of return piping. Each drip valve has a sight-feed control for adjusting liquid flow to needs of system. *Suhm Co, 1942-F S Kinnickinnic Ave, Milwaukee 4, Wis.*

Time-Program Control

MODEL 431 PYROMASTER potentiometer pyrometer has time-program control. Controllers automatically regulate temperature, not necessarily at a fixed point, but rather carry



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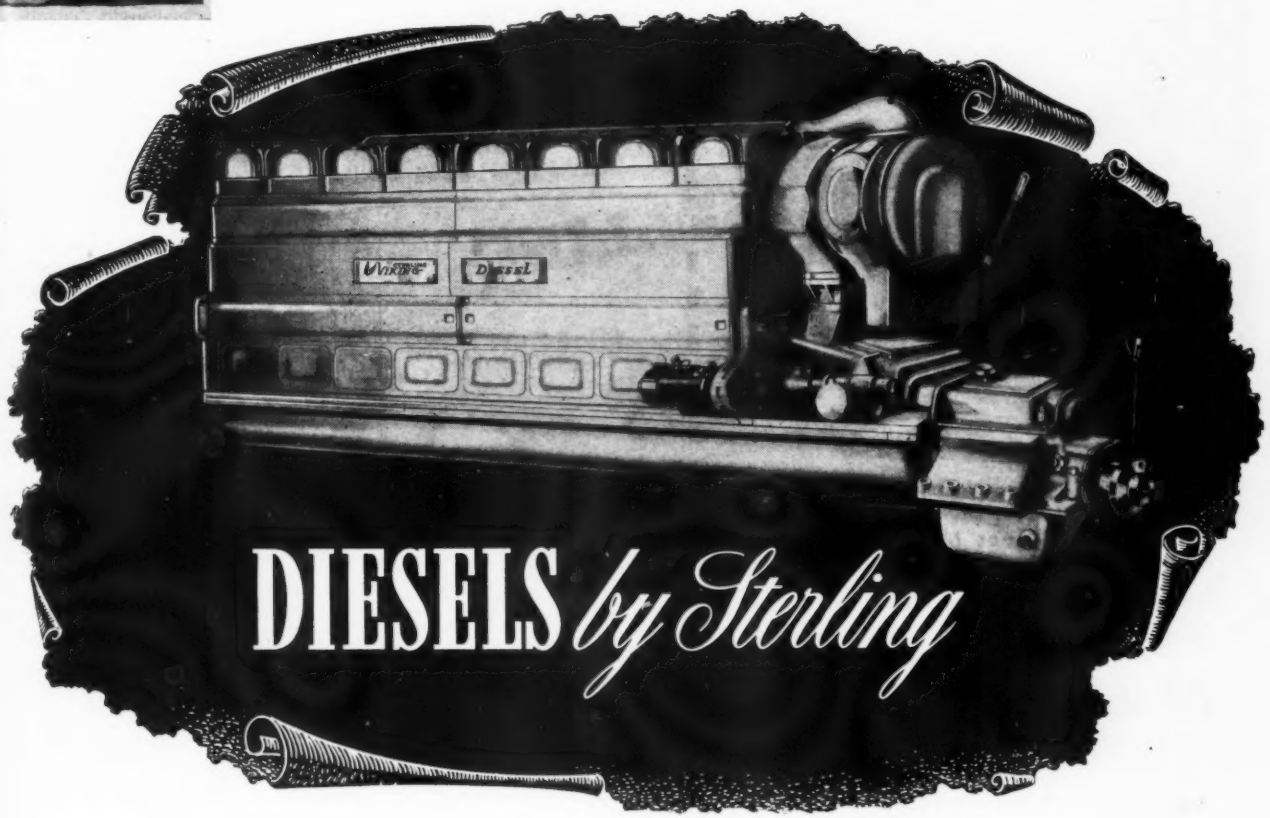

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FIFTEEN years have been spent in designing, building and testing the new Sterling Viking diesel. Now the engine of the future is ready for you today.

Into this masterpiece of engineering design and craftsmanship has been built the most advanced thinking of our times to give you an engine as compact and efficient as a gasoline engine of the same power rating—plus the economy of diesel fuel.

It bears a name which for forty years has been the mark of dependability.

If you are planning a change in your war-tired power plant—write for complete specifications of the Sterling Viking diesel—newest in the line of Sterling engines—diesel, gasoline or gas ranging in power from 85 hp. to 1200 hp.

"KEEP BUYING WAR BONDS"

ARMY (E) NAVY

STERLING VIKING DIESEL

STERLING ENGINE COMPANY 1271 Niagara St., Buffalo 13, N. Y.

New York City, 900 Chrysler Bldg. • Washington, D. C., 806 Evans Bldg. • Chicago, Illinois, 855 Board of Trade Bldg.

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WHY does MAGNOLIA ANTI-FRICTION METAL out-sell all other maintenance bearing alloys? There are three reasons:

MANY APPLICATIONS **Having the lowest coefficient of friction of any known bearing metal, it provides the best lining for nine out of ten applications.**

PRE-WAR COMPOSITION **While many bearing metals have disappeared from the market, MAGNOLIA ANTI-FRICTION is still available. And, furthermore, its composition remains unchanged.**

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it through a predetermined series of changing values. Blank metal cams, with time and temperature graduations printed on cam face, enable user to cut his own cams with a pair of tin snips. Controller can be any of five air-operated models or several electric types of control, and in ranges up to 3000 F for thermocouple controllers and up to 3600 F with compensated radiation unit. *Bristol Co, Waterbury 91, Conn.*

Water Softener

IMPROVED ELGIN zeolite water softener has a water distributing and collecting manifold system, equipped with double-check valves and strainer nozzles, which permits far deeper zeolite bed without zeolite loss. Operating principle also provides more effective backwashing, more efficient regeneration and a new self-cleaning action. These and other features are said to provide up to 44% increase in softening capacity. *Elgin Softener Corp, Elgin, Ill.*

Tachometer

INSTRUMENT RANGE runs from 500 to 3000 rpm. Tachometer weighs 5½ oz; dia is 2¼-in., permitting one-hand manipulation. Speed in rpm is read without timing or counting device. Readings are constant and, according to manufacturer, record fluctuations which it is impossible for tachometers now on market to register. A pointed contact spindle is for use with centered shafts and an elastic tip slips over pointed spindle for shaft ends that are not centered. *Standard Machinery Co, Providence 7, R. I.*

Flexible Connectors

LARGE-DIAMETER flexible corrugated stainless-steel tubing, in long-bent lengths, is for diesel-engine exhaust and high-temperature vapor lines. Connectors absorb expansion, contraction and extreme deflection in all planes. Supplied in 6-in. and larger diameters in carbon steel, stainless steel and other corrosion-resistant alloys, they require no packing and, having no seams, are permanently gas-tight. Connectors handle cor-

METALLIC AND FIBROUS PACKINGS FOR EVERY PURPOSE

THE ANCHOR PACKING COMPANY

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Tulsa 4, Oklahoma	823 South Gary Place
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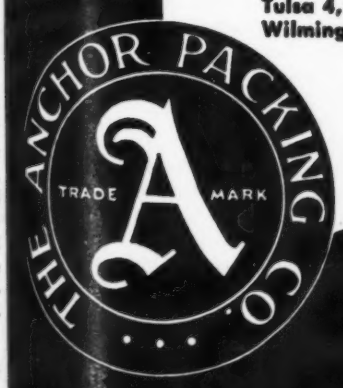

Put "AMBEST" to a long life test on any tough job

EUREKA

This UNIVERSAL packing—of long, pliable, anti-friction metallic alloy strands—assures low cost, long life packing protection and easy application on any rod in good condition. "AMBEST"—available for all pressures and temperatures up to 550° F. — is recommended for pumps, compressors, engines, throttles and valve stems. All needs are supplied by one packing when you use "AMBEST."

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Send for 36 page catalog

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PYREX BROAD RED LINE

For use in those "Hard to See" Places

The PYREX Broad Red Line Gauge Glass is made just for that purpose—to make it easier for you to see the water line where visibility is poor. The broad red transparent line is magnified by the water column so that the liquid level is clear and distinct.

Made with machine drawn accuracy—that reduces breakage from installation strains; made from special resistant glass, they withstand solvent action of steam or hot water and sudden temperature changes and mechanical shock. They stand up under severe operating conditions.

Regardless of your requirements, you will be able to select the right Gauge Glass from the complete CORNING and PYREX Line.

Bulletin 817 tells you more about these Gauge Glasses and the places they fill. Write for your copy to Industrial Sales Department, PO11, Corning Glass Works, Corning, N. Y.

PYREX brand High Pressure—resistant to thermal shock and mechanical shock and attack of steam and hot water. Machine drawn accuracy.

PYREX brand Red Line—Same but with added visibility afforded by enameled red line.

PYREX brand Broad Red Line—Same but with fused-in broad red line for extra visibility.

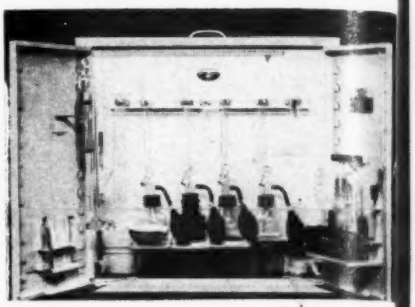
CORNING Standard—For moderate pressures. Long-lasting. Machine drawn accuracy.

"PYREX" *and* "CORNING," *are registered trade-marks and indicate manufacture by Corning Glass Works, Corning, N. Y.*

CORNING Glass Works Corning, New York

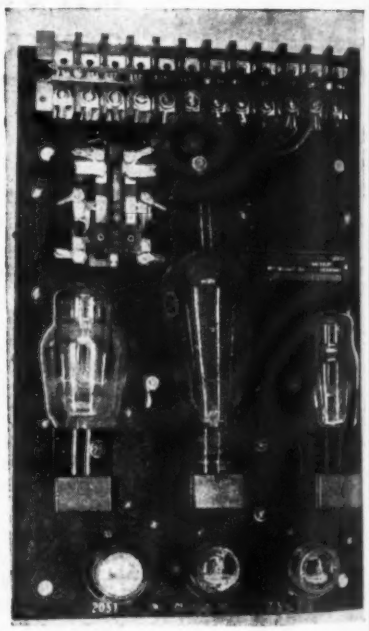
Pyrex Gauge Glasses

rosive liquids and gases under pressures up to 30 psi and at temperatures from sub-zero to 1800 F. Connectors for absorbing linear expansion are for pressures up to 300 psi. *Zallea Brothers & Johnson, Wilmington 99, Del.*



Feedwater Tester

TESTMASTER CABINET provides a flexible and rapid means for testing boiler and feedwater samples to determine and properly regulate treatment dosage and blowdown requirements. Compact all-metal adjustable cabinet accommodates any number of or all tests, including hardness, alkalinity, chloride, phosphate, pH, sulphite and dissolved oxygen. *TruTest Laboratories, Inc, Jefferson Bldg, Philadelphia 7, Pa.*



Forge-Pressure Timer

ELECTRONIC FORGE-PRESSURE TIMER, for dual pressure spot welding machines of capacitor discharge design, supplies accurately timed forge pressure so that required welding energy, cracks, indentations and sheet separation are reduced. Calibrated in milliseconds, timer consists of a timing circuit with a regulated dc source of voltage, electronic tubes and a time-delay relay with fixed timing. Timer mounts on a small steel base for addition to any GE capacitor discharge control already installed, provided resistance welding machine has a dual pressure system for this purpose. *General Electric Co, Schenectady, N. Y.*

IT'S YOUR POSTWAR ELECTRICAL HOME

—See that it works!

THINK of your electrified home to come . . . big and little appliances of all kinds . . . advanced heating . . . air-conditioning . . . better lighting . . . television . . . All fine servants—but they will be handicapped if you give them insufficient electrical capacity.

So often electrical wiring plans are based on *past* electrical experience—a poor guide to the needs of peak loads to come. It's far safer to plan *reserve* capacity in line with the huge future increase in electrical usage. You'll save yourself plenty of grief later in breakdowns and expensive alterations.

Manufacturers! Apply this in terms of industrial equipment in *your* business. The problem's the same. Make sure you have ample electrical capacity to meet the huge future increases in electrical usage sure to come. In plants too, planned wiring will cost a lot less than unplanned wiring.

Before structures get out of the planning stage, it will pay to consult electrical contractor, utility power engineer, plant power engineer. They'll agree that it's always wiser to *Wire Ahead!* 44265

ANACONDA WIRE & CABLE COMPANY

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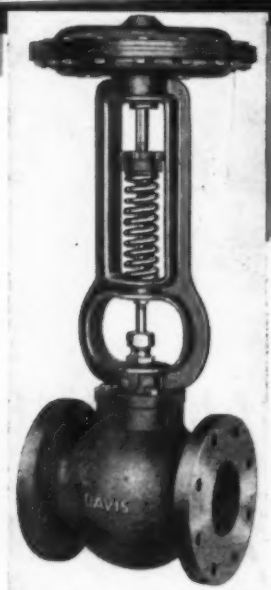
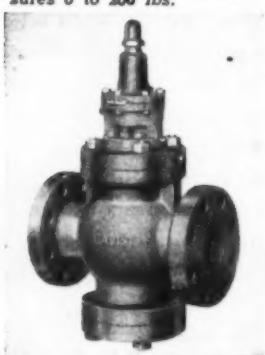
It's Always Wiser to WIRE TELEGRAM AHEAD TELEGRAM

to *Simplify* the selection of Pressure Regulators...

	FOR STEAM, AIR AND GAS *ALSO RECOMMENDED FOR WATER AND OIL													FOR WATER			FOR GAS	
REGULATOR No.	2*	8	13	14*	15	16*	18*	19*	26*	27*	40	49*	408*	17	21	48	9	20
MAXIMUM INITIAL PRESSURE	600	1500	400	400	250	400	250	250	125	125	400	1500	1500	250	125	400	250	250
MINIMUM REDUCED PRESSURE	1	0	½	0	0	0	↑	↑	↑	1	1	0	1	-0	½	10	⅛	¼
MAXIMUM REDUCED PRESSURE	125	300	100	200	30	125	↑	↑	↑	15	300	100	500	100	60	200	100	100
FOR DEAD END SERVICE			✔				✔	✔	✔		✔	✔		✔	✔	✔		
DIAPHRAGM ACTUATED—Direct Acting			✔	✔	✔	✔	✔	✔	✔	✔					✔		✔	✔
PISTON ACTUATED—Direct Acting	✔										✔	✔	✔	✔		✔		
AUXILIARY PILOT CONTROL		✔						✔	✔	✔	✔	✔			✔	✔		
SPRING LOADED			✔	✔									✔	✔			✔	✔
WEIGHT LOADED	✔	✔			✔	✔	✔				✔		✔	✔	✔	✔	✔	✔
SERVICE: GENERAL SERVICE	✔	✔		✔	✔	✔												
SERVICE: LOW PRESSURES—Heating	✔		✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔			✔	✔	✔
SERVICE: HEAVY LOAD DEMANDS		✔			✔	✔				✔	✔	✔	✔					
SERVICE: SPECIAL SERVICE		✔	✔	✔	✔	✔	✔	✔	✔	✔			✔	✔				
*RANGE OF SIZES	½ to 14	4 to 20	½ to 8	½ to 12	½ to 14	½ to 14	½ to 14	½ to 14	½ to 2	½ to 2	½ to 10	½ to 14	½ to 14	2 to 6	½ to 2	2 to 14	½ to 14	½ to 14



Above—No. 14. Direct connected spring loaded regulator. For steam, air, gas, water, oil. For pressures to 400 psi. For reduced pressures 0 to 200 lbs.



Above — No. 40 for heavy duty, variable load conditions. Unaffected by high pressure fluctuations. Self-contained, Pilot operated. For pressures to 400 psi.

...consult DAVIS

The variables encountered in the application of pressure regulators are so numerous that they make selection of the proper regulator a tough job at best. Yet, because choice of the proper type of regulator determines to such a very great extent the efficiency of the installation, it is essential that the job of selection is not slighted. To help you choose the proper regulator, Davis offers a number of helps:

1. A truly *complete* line of regulators to meet nearly every conceivable requirement. 18 different types for steam, air, gas, water, oil. Sizes to 24". For pressures to 1500 lbs.

2. Literature and selection charts that provide *complete* information in easy-to-use form.

3. Engineering consultation on regulator problems.

4. Ability to design regulators to meet any requirement, no matter how special.

For additional information, write today on your company letterhead and request a copy of Bulletin 100 A.

DAVIS REGULATOR CO.
2540 S. Washtenaw Ave., Chicago, Illinois

DAVIS VALVES

DAVIS REGULATOR COMPANY

Power News

(*Continued from page* 134)

Most of the deficit is in highgrade Appalachian coals, which practically all types of Eastern and Middle Western industries have used in the past. Moreover, bituminous stockpiles, greatly reduced by last year's production deficit, no longer offer a cushion against the inability to produce enough wartime coal.

Because of the shortage in highgrade Eastern coals, SFAW is taking emergency measures to build up stockpiles of steel and by-product coke plants to safe levels. Since production cannot be increased, coal for these piles must be diverted from industries that can use alternatives for steam generation.

Railroads and steam plants have already given up great tonnages of scarce Appalachian fuels to keep vital war industries at full capacity. Now, to rebuild depleted stockpiles at steel and by-product plants 1,680,000 more tons must be diverted from steam uses, at a rate averaging 420,000 tons a month before Jan 1. Industries losing the coals must turn to alternative deep-mined or trip-mined coals.

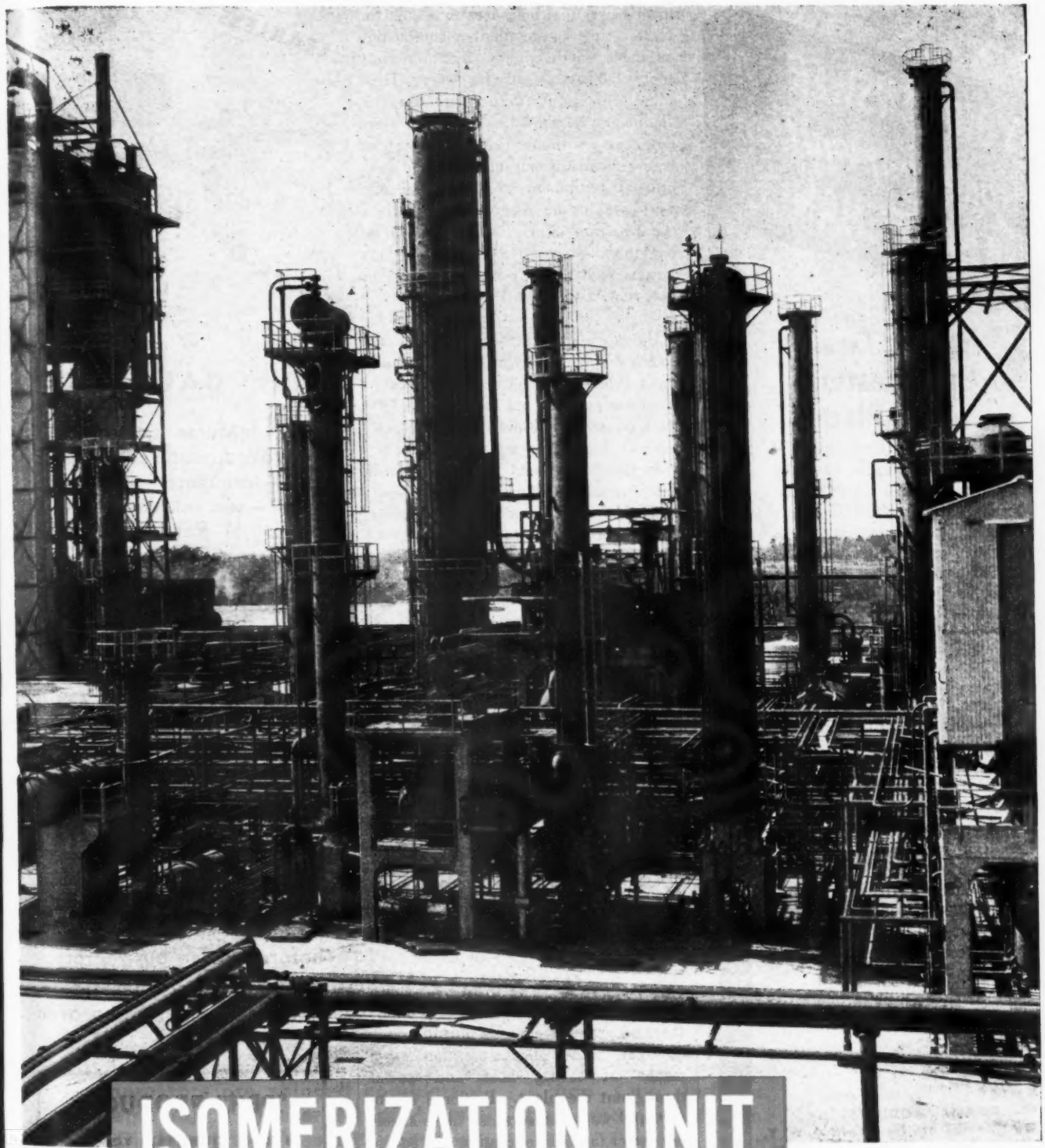
In numerous instances, coal of lower Btu value will have to be accepted, thus increasing plant tonnage. This and other differences in quality and characteristics of alternative fuels will create problems that must be met promptly in the interest of fuel economy and conservation of resources. Even though Germany should collapse by early winter, immediate fuel relief is not expected. Industry's only safe policy is to continue strict economy in the months ahead.

SFAW and Bureau of Mines will assist plants whose managers must procure fuels to replace Eastern by-product coal, diverted from steam use to coke plants. For information, communicate with any local SFAW representative or their nearest regional office.

Fuel Efficiency Program

To combat waste in burning coal and other fuel, Bureau of Mines, in cooperation with SFAW has instituted a National Fuel Efficiency Program, providing expert advice for industrial plants using coal for power generation and other purposes.

For greatest efficiency in an industrial plant, a trained engineer locates escaping heat and power, and recom-



ISOMERIZATION UNIT

EASTERN STATES PETROLEUM COMPANY (OF TEXAS)

HOUSTON, TEXAS

The Piping for this Unit was Fabricated by

BENJAMIN F. SHAW COMPANY

Second & Lombard Streets **Wilmington 99, Delaware**

Known for Dependable Delivery and Quality

Pre-Fabrication— Piping Installation

SINCE 1893

YOUR ANSWER for speeding wartime MAINTENANCE

How to Clean Unit Heaters . . . In Place!

Heating efficiency of unit heaters depends largely upon clean, dirt-free coils. Keep YOUR heaters in top-working order by cleaning periodically this easy Oakite way.

WITHOUT dismantling equipment, apply recommended solution of Oakite Composition No. 20, either by steam or compressed air, through the Oakite Solution-Lifting Gun, Model No. 391. The two-fold function of effective detergent action and mechanical force makes quick work of ridding coils of dust, oil and other foreign matter. Method saves time, money. Units quickly restored to normal efficiency.

Details FREE on Request!

Send for FREE Special Service Report giving complete details TODAY!

OAKITE PRODUCTS, INC.
23 Thames St., New York 6, N. Y.
Technical Service Representatives Located in All Principal Cities of the United States and Canada

OAKITE *Specialized* CLEANING

Buy Bonds for Victory

mends practical measures to adjust the faults. In a large plant a combustion engineer saves money by increasing fuel efficiency. But for every large plant with its own expert, hundreds of smaller ones depend upon firemen and engineers without benefit of special training and without improved and modernized equipment to detect and prevent escaping heat and power. To them the program offers the cooperation of engineers whose advice is free. Many larger plants are cooperating in the program with fresh emphasis on fuel saving.

Bureau of Mines' National Fuel Efficiency Council of twelve men includes smoke abatement engineers and experts from coal, oil and gas industries. They work on policy matters and special problems in certain regions and industries.

In the field, about 200 local coordinators serve the industrial centers where they live. Each coordinator appoints an advisory committee, which may be composed of local engineering experts, industrial leaders, smoke inspectors and representatives of the chamber of commerce, coal association and board of education. He also appoints regional engineers to inspect plants and make fuel efficiency recommendations. These engineers, working without pay, seek cooperation of office buildings, laundries, theaters, schools, bakeries, foundries, factories, etc. The plant manager appoints a "waste chaser" who accompanies the visiting engineer on an examination. In special problems of heat control or special fuel use, services of experts may be had without charge. As a result, hundreds of plants have effected substantial savings in fuel costs.

Quiz Sheets

Important in the program is the quiz sheet on subjects such as burning coal, oil, gas, and boiler operation as a means of saving heat and power throughout the plant. Regional engineers and waste chasers use these sheets to correct faults in operation and equipment. They give expert advice on plugging heat leaks in boilers, furnaces, smoke pipes, stokers, fan housing, air ducts and windboxes. They also show how to set stoker controls properly and how to clean and bank fires.

On inspections every use of steam, electricity, water, compressed air, gas, refrigeration or other facility is studied in detail by waste chaser and engineer. Many measures require only minor repairs, an added piece of insulation or a new valve part.

In almost every fuel-consuming plant ...ities for improvement can best

LEAKLESS SPRINGLESS

"PBH" GAUGE COCK

Four features of Huyette's *improved* gauge cocks—leakless—springless—quick opening — self-closing — result from: 1) Renewable monel metal seat and stainless steel pencil easily and quickly renewed if necessity demands, without detaching cock shank from water column. 2) Body and stem made of bronze mixture according to ASME Code; 3) A pull of the chain opens the gauge cock and the weight, by gravity, immediately and automatically closes it; 4) Weight is easily and quickly adjustable — no springs to rust or break.

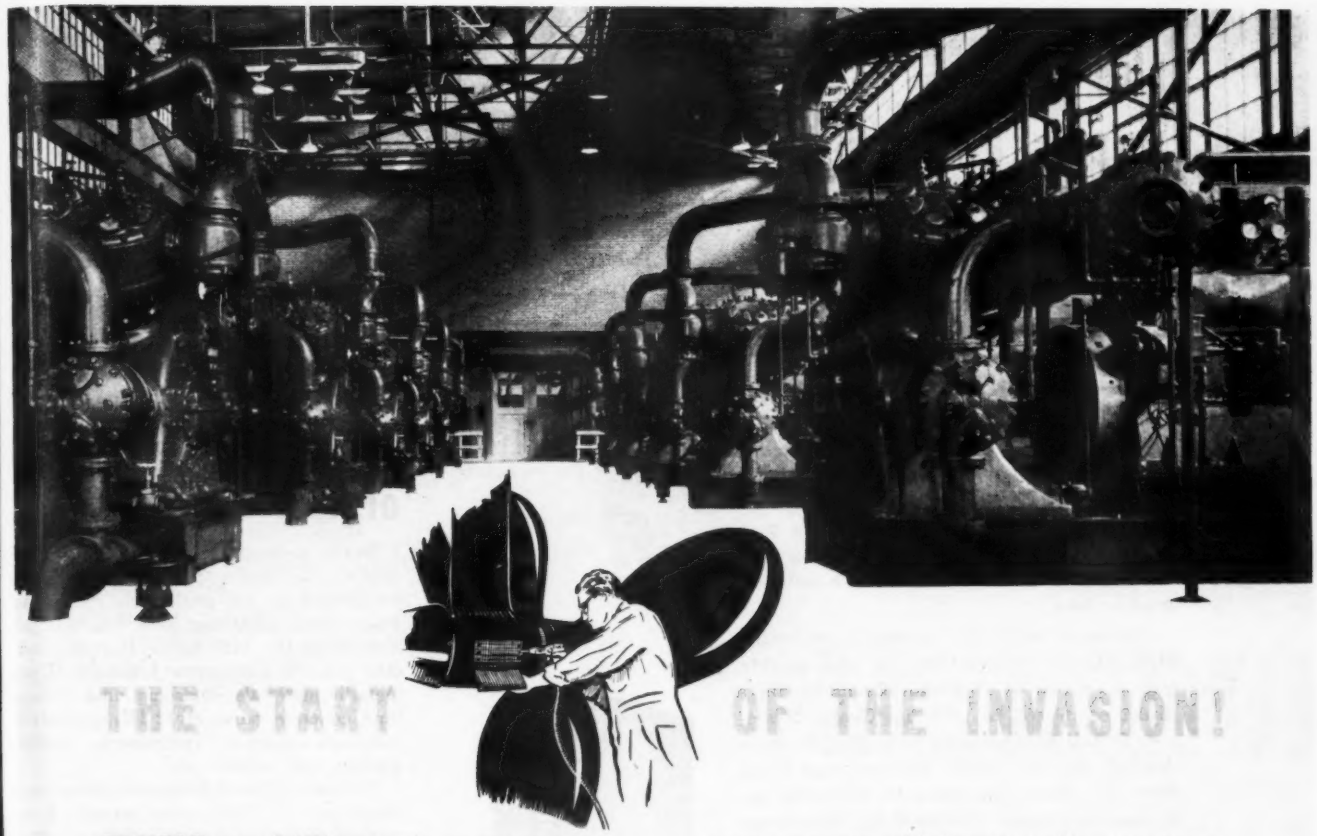
Every Huyette Gauge Cock is rigidly tested and inspected before leaving our factory.

Write today for Bulletin describing the "PBH" *improved* Gauge Cocks.

"PBH" PRODUCTS

Water gauges, vertical and inclined — Gage-Glass Protectors — Airtite Boiler Wall Coating — Water Columns — Boiler Alarms, Instruments and Controls.

The PAUL B. HUYETTE CO., INC.
Established 1896
401 N. BROAD STREET PHILADELPHIA, PA



THE START OF THE INVASION!

THESE ten Sullivan air compressors furnish the air power—15,000 cubic feet of it every minute—that operates the thousands of tools used in building many of the ships that form the life line of the invasion.

Chipping hammers, sand rammers, air hoists, sand blast machines, grinders, spray guns and the countless other tools that are used in this huge plant are powered entirely by this battery of heavy-duty, continuous-service compressors.

Sullivan WN-114's were chosen for this important war job for a number of reasons: They were easily and economically installed (all Series 100 compressors are shipped completely assembled). They were ideally suited for Diesel drive (Series 100 compressors operate efficiently with any type of drive). They require little floor space (compact design made this saving possible). They carried an endorsement from industry for their lower maintenance costs (since 1937, when the first Series 100 was built, these modern compressors have been used in every type of industry with unqualified success).

The efficient Sullivan Series 100 air compressor has been an important factor in the creation of wartime production records. It is also playing an equally important role in the post-war plans of far-sighted executives. Sullivan Machinery Company, Michigan City, Indiana. IN CANADA: Canadian Sullivan Machinery Co., Ltd., Dundas, Ontario.

SULLIVAN

AIR COMPRESSORS FROM ¼ TO 3,000 H.P.

ARMY NAVY E

OFFICES—Seattle • Boston • New York • Chicago • Portland • Pittsburgh • St. Louis • Detroit • San Francisco • Birmingham • Knoxville • Huntington • Los Angeles • Duluth • El Paso • Butte • Salt Lake City • Scranton • Denver • Dallas.

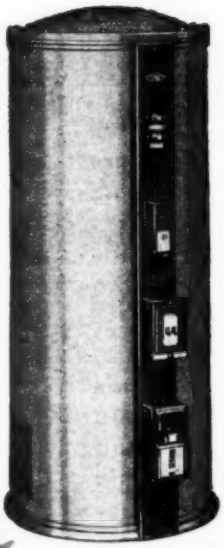
PRODUCTS—Stationary and Portable Air Compressors from ¼ to 3000 H. P. • Pneumatic Casting Grips • Foundation Breakers • Portable Hoists • Rock Drills.

the important jobs go to HONAN-CRANE

LEADING ENGINEERS and operators have made Honan-Crane "Continuous" Oil Purifiers their first choice in oil purification equipment. The superior efficiency of Honan-Crane Purifiers in both fuel and lube installations is making possible operating records far above ordinary expectations.

Pictured below is another outstanding Honan-Crane installation. In this picture you see a row of 12 Honan-Crane Purifiers direct connected to 1000 hp. Cooper-Bessemer G-MV Compressors in a new Western Arsenal. In this plant, Honan-Crane Purifiers are direct connected to 24—1000 hp. Cooper-Bessemers, 19—1000 hp. Worthington and 11—1450 hp. Rathburn Jones engines, a total of 68,950 hp.

Honan-Crane Purifiers are replacing strainer and centrifugal type filters in many plants. Investigate the superior efficiency of Honan-Crane Purifiers and see what they will do for your engines. Write today for complete specifications and engineering bulletins on the purification of lube and fuel oils.

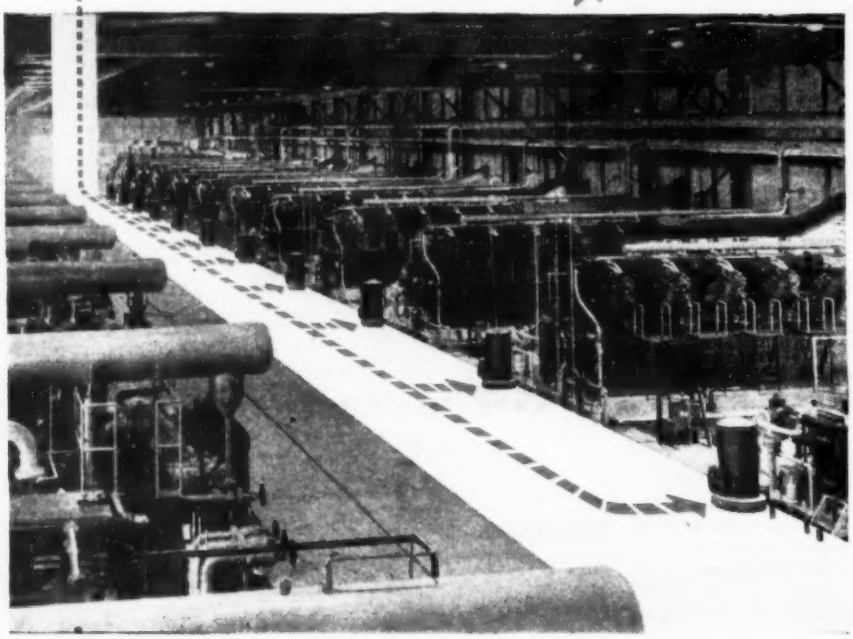


HONAN-CRANE CORP.

Subsidiary of Houdaille-Hershey Corporation

1200 SIXTH AVE.

LEBANON, INDIANA



be discovered by periodic inspection and tests of boilers and other equipment, with necessary overhauling and checks on fuel consumption. Detailed inspections bring out unusual methods of effecting economies in plant power services. Government is working constantly with research agencies of fuel and equipment industries to improve firing methods and plant facilities for better results and elimination of waste.

For the program's operating details, write National Fuel Efficiency Section, Bureau of Mines, Washington, D. C.

ASTM Advances Date Of Its Book of Standards

Heavy demands for the 1942 Book of ASTM Standards and its supplements occasioned by war-production efforts have necessitated advancing by a full year publication of the next book. It covers some 6000 pages in three parts: I, metals; II, nonmetallic materials—constructional (cement, lime, concrete, paint, etc); III, non-metallic materials—general (petroleum, textiles, plastics, coal, rubber, etc).

Two new tests of interest to power engineers are: (1) *Non-ferrous metals:* A new method of determining resistivity of copper and copper-and-copper-alloy electrical conductors should be of considerable help to the industry. The new method, which covers apparatus, test specimens and methods to be followed, is intended to have an accuracy of 0.50% for material with resistance of 0.0001 ohm or more. (2) *Embrittlement testing of boiler water:* These new methods, D 807, culminate a most extensive investigation carried on by the Joint Research Committee on Boiler Feedwater Studies over a period of some ten years. In much of the work the U. S. Bureau of Mines took an active part through its research stations and technologists, and the new test uses the embrittlement detector that was developed by W C Schroeder and A A Berk. Nonexclusive licenses for manufacture and distribution are given at the discretion of the Secretary, U. S. Dept of the Interior.

Postwar Manufacturing Materials at Power Show

Forthcoming sessions of the biennial Power Show (Madison Sq Garden, Nov. 27 to Dec. 2) were originally planned to serve in great part as a war-production aid. The literal explosion of the invasion under Germany's westwall, plus political pressures for shaping reconversion plans before the national election, have sharply altered the industrial outlook. It now appears that the Exposition will cater more strongly to civilian production needs.

But because of preparations to continue the state of war indefinitely regardless of Germany's expected capitulation, many exhibits will contain samples of war products as well as mechanical equipment, materials and supplies pertaining thereto. Moreover the logistics of the armies of occupation, plus demobilization of the fighting forces

FLAMENOL

Simple test demonstrates value of G-E synthetic cable

Before you install wiring in a location where there is danger of fire, *first* make this test:

Light a match, and hold a piece of Flamenol* wire in the flame. Use several matches, one after another. The insulation will char, but it will *not* burst into flame. Therefore, Flamenol gives you this assurance: If fire *does* break out, *it will not be spread by the wiring.*

Flamenol Has Proved Itself

The insulation on Flamenol wire and cable is *not* a newly developed and temporary substitute. Designed to overcome the disadvantages inherent in other insulations, it has been in commercial use more than *eight years.* Its many advantages, listed at right, have been proved under severe conditions of service in thousands of industrial installations.

As a result of thorough tests carried out over long periods of time, many of the country's leading chemical, oil, automotive, and other companies changed to Flamenol long before the rubber shortage. For further information, constructions, suggested uses, etc., write to the nearest G-E office. *General Electric Company, Schenectady, N. Y.*

12 BIG ADVANTAGES offered by FLAMENOL

1. FLAME RESISTANCE—does not support combustion.
2. CORROSION RESISTANCE—immune to action of oils, acids, alkalies.
3. SUPER-AGING — does not oxidize. Highly resistant to sunlight and weathering.
4. EXCELLENT PHYSICAL PROPERTIES—has minimum tensile strength of 1500 lb per sq in., minimum elongation of 100 per cent.
5. DIELECTRIC STRENGTH — retained at about 720 volts per mil through severe operating conditions.
6. SMALL DIAMETER — saves space, facilitates wiring.
7. SMOOTH SURFACE—facilitates pulling through conduit.
8. FREE STRIPPING—speeds splicing, avoids nicking conductors.
9. DIFFERENT COLORS —simplify circuit tracing.
10. VARIOUS CONSTRUCTIONS—aid selection for special applications.
11. SELF-PROTECTING FINISH — eliminates need for braid, less space required.
12. ATTRACTIVE APPEARANCE—is maintained through long service, painting is never needed.

BUY WAR BONDS

*Reg. U.S. Pat. Off.

GENERAL ELECTRIC

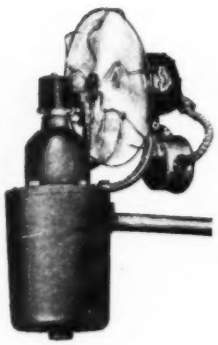
DRY AIR is a *Costly Nuisance*

CONTROLLED HUMIDITY:
PREVENTS MOISTURE LOSS
PREVENTS WEIGHT LOSS
MAINTAINS QUALITY
ELIMINATES STATIC
CONTROLS DUST
IMPROVES HUMAN COMFORT

Combat it with ARMSTRONG *Steam Type* HUMIDIFIERS

Armstrong Unit Humidifiers offer big advantages in chemical, food, paper, printing, textile, explosive, woodworking, ceramic, tobacco, leather and other industries. No other method of humidification offers the following combination of features:

Installed like unit heaters.
Do not add to heating load.
Extremely sensitive—highly accurate
Do not drip or form puddles.
Can be installed anywhere.
Quiet and dependable.
Economical—as low as two cents per hour.
Big capacity—40,000 cu. ft. per hr. on smallest model.
Inexpensive to install.
Seldom require maintenance.



NEW BULLETIN NO. 158
An educational discussion on humidification. Includes charts, data, tables; describes Armstrong Humidifiers completely. Ask for a copy.

ARMSTRONG MACHINE WORKS
812 Maple Street, Three Rivers, Mich.

ARMSTRONG
STEAM TYPE UNIT HUMIDIFIERS

will perpetuate a sharp division in many branches of industry between government and private work for many months to come.

One of the most important purposes of the Exposition will be to assist in forming judgments as to the probable availability and uses of various manufacturing materials in months to come. On such judgments depends largely selection of designs for manufactured products and all the problems of plant equipment, arrangement and power supply involved.

Easing of the materials situation will permit resumption of normal activities by many industries but not normal freedom of choice. It would not be surprising, therefore, if plant changes were frequent for many months to come, all of which implies a lively market for the Exposition products.

Every problem connected with generation, distribution, control and application of heat and power in manufacturing is reflected in more ways than one by the power show displays. Further light is contributed by the consultation service that all exhibitors make a special point of providing.

A preliminary review indicates that the following products will be well represented: heat and power production, distribution of energy, control appliances, auxiliary apparatus, instruments for indicating and recording measurements of quantities and pressures, power transmissions, materials-handling equipment, engineering materials, and specialties, machines and tools.

Like its predecessors, the Power Show will be closed to the public and open only by invitation and registration to persons associated directly with power field activities. More space has been provided than at the exposition two years ago, and a greater number of exhibitors is to be accommodated by restricting size of booths. The show is under the management of the International Exposition Co, of which Charles F Roth, manager of the show, is president.

WPB Announces a Reconversion Program

J A Krug, acting chairman of War Production Board, announces that the Army, Navy and major war agencies have agreed on a program to provide the utmost stimulus to reconversion when Germany is defeated, while protecting production for the Japanese war. Acting upon findings that there will be a reduction of about 40% of war production within three months after Germany's defeat, which will free over 4,000,000 workers, the Board decided to:

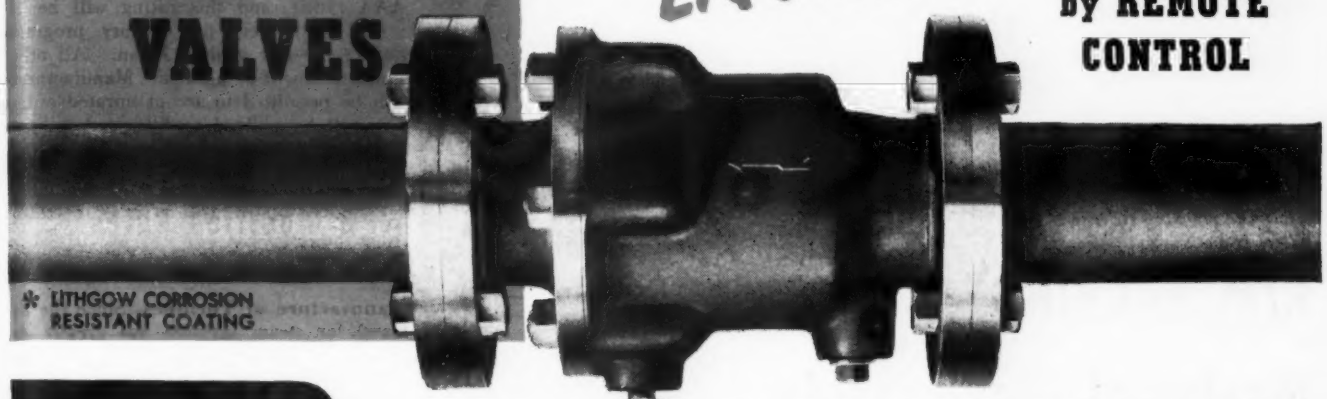
(1) Remove almost all controls over materials immediately upon the defeat of Germany except those necessary to assure the reduced measure of war production necessary to beat Japan. This means that any plant and materials not needed for military production can be used for civilian.

(2) WPB and other Government agencies will do everything in their power to assist and encourage industry in resuming civilian production and maintaining employment through the "know-how" of its industry divisions and industry and labor advisory committees.

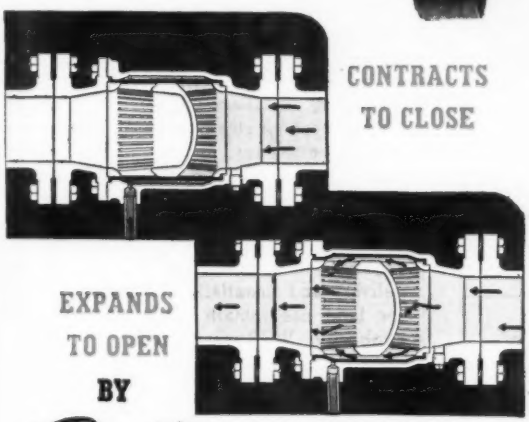
(3) The Board will maintain its organization and powers so as not to relinquish authority until it is certain the war-pro-

GROVE INNER-COATED* FLEX-FLO VALVES

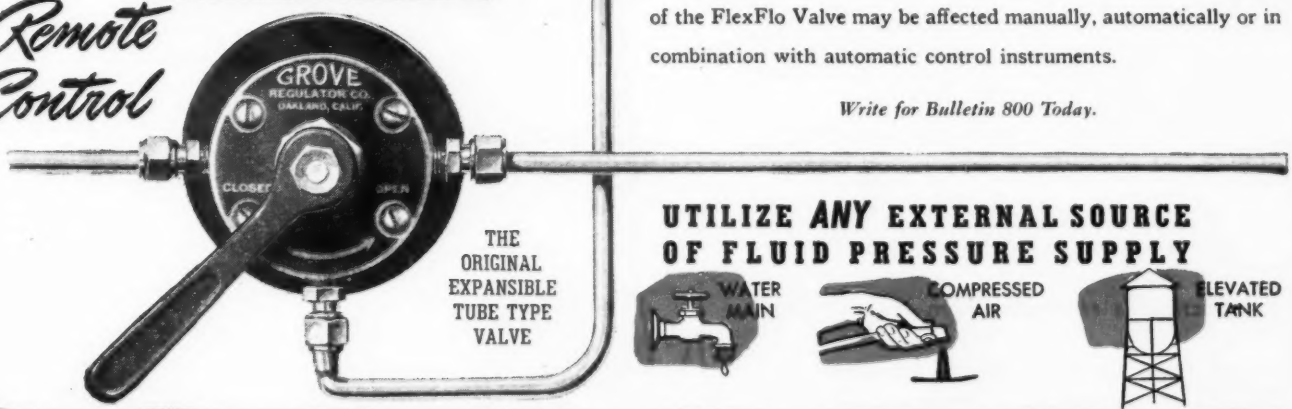
HANDLE CORROSIVE LIQUIDS AND GASES by REMOTE CONTROL



* LITHGOW CORROSION RESISTANT COATING



BY *Remote Control*



THE ORIGINAL EXPANSIBLE TUBE TYPE VALVE

Grove FlexFlo Valves employ just one (non-metallic) moving part—a flexible synthetic rubber tube which expands to open and contracts to close. Therefore, there are no rubbing surfaces—no seats, discs, stuffing boxes, etc., to wear, stick or leak. All inner surfaces of the valve are completely protected with resilient Lithgow synthetic coating which impregnably resists highly corrosive fluids and gases, and eliminates any possibility of electrolytic action. Line fluid is hermetically sealed off from the external operating medium by the flanged lips of the cylindrical expansible tube which is securely anchored within the valve body. External remote control operation of the FlexFlo Valve may be affected manually, automatically or in combination with automatic control instruments.

Write for Bulletin 800 Today.

UTILIZE *ANY* EXTERNAL SOURCE OF FLUID PRESSURE SUPPLY

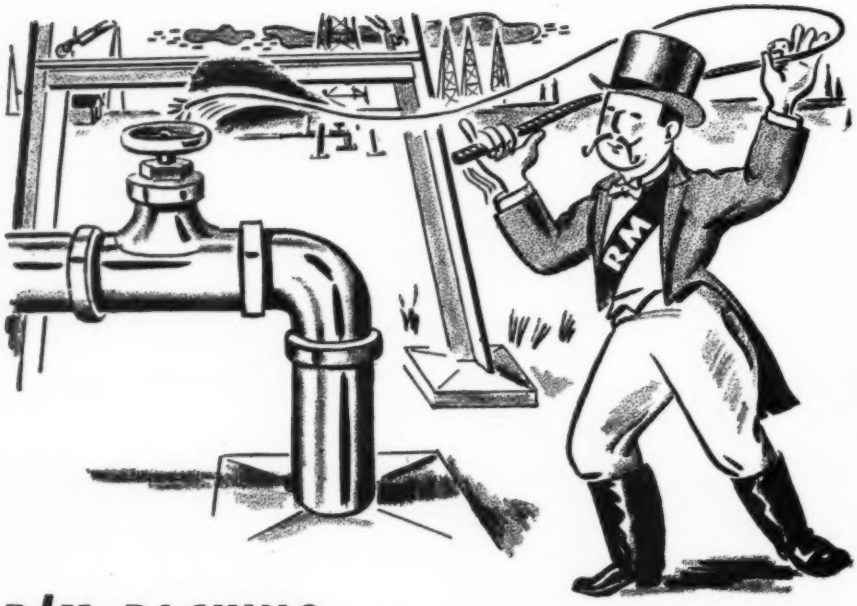
GROVE FLEX-FLO REMOTE CONTROL VALVES

GROVE
SIMPLICITY
ACCURACY
SAFETY

GROVE REGULATOR COMPANY

6547 GREEN STREET, OAKLAND 8, CALIFORNIA. *Branch Offices:* 30 Rockefeller Plaza, New York 20 • 5644 Navigation Boulevard, Houston 11, Texas • 1930 West Olympic Boulevard, Los Angeles 6, California

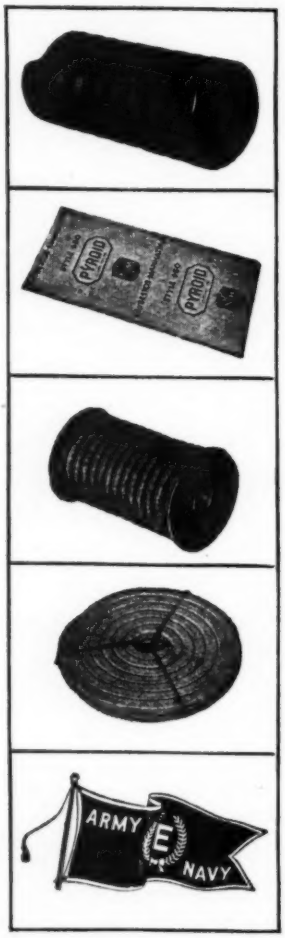
WRITE TODAY FOR BULLETIN 800



R/M PACKING···
Master of Tough Fluids

Oil, ammonia, acids, alkalis—they are all in a day's work for R/M Packings. Keeping these fluids in line, and keeping them there longer and better — that's R/M's contribution to this war. Constant laboratory research and development, and over 40 years of experience have made this possible.

And when the war is over and R/M production is released from service, you'll find R/M packings will deliver outstanding performance for you, too.



RM

INDUSTRIAL SALES DIVISION

RAYBESTOS-MANHATTAN, INC.

MANHEIM, PENNSYLVANIA

Bridgeport, Conn. ★ North Charleston, S. C. ★ Passaic, N. J.

MAKERS OF PACKINGS FOR EVERY INDUSTRIAL USE

duction program is adequate for victory over Japan.

Industry is to have its own way, according to availability of markets, men, materials and plants to do the swiftest and most effective job possible of restoring production, making whatever people want and affording maximum employment as quickly as possible. The plan is simple in outline. Detailed procedures for putting it into effect will be developed promptly. It provides that there will be only one preference rating, in addition to the present emergency AAA rating, and this rating will be reserved exclusively for military programs during the war against Japan. All other production will be unrated. Manufacturers will be permitted to accept unrated orders but will be obliged to fill rated military orders ahead of all other business.

WPB Modifies Rules In the Power Field

Manufacture of Turbines. Since the demand for steam turbines has greatly decreased in recent months, WPB has lifted restrictions on use of auxiliaries and special equipment for turbine manufacture. Restrictions were removed by revocation of Schedule VI to Limitation Order L-154, governing auxiliary equipment and appurtenances for steam turbines for land use. Many petroleum and synthetic rubber projects that required large numbers of turbines have been completed and new facilities have come into production, permitting fulfillment of all marine programs requiring turbines. However, manufacture, delivery and installation of steam turbines for land use remain subject to all other applicable WPB regulations.

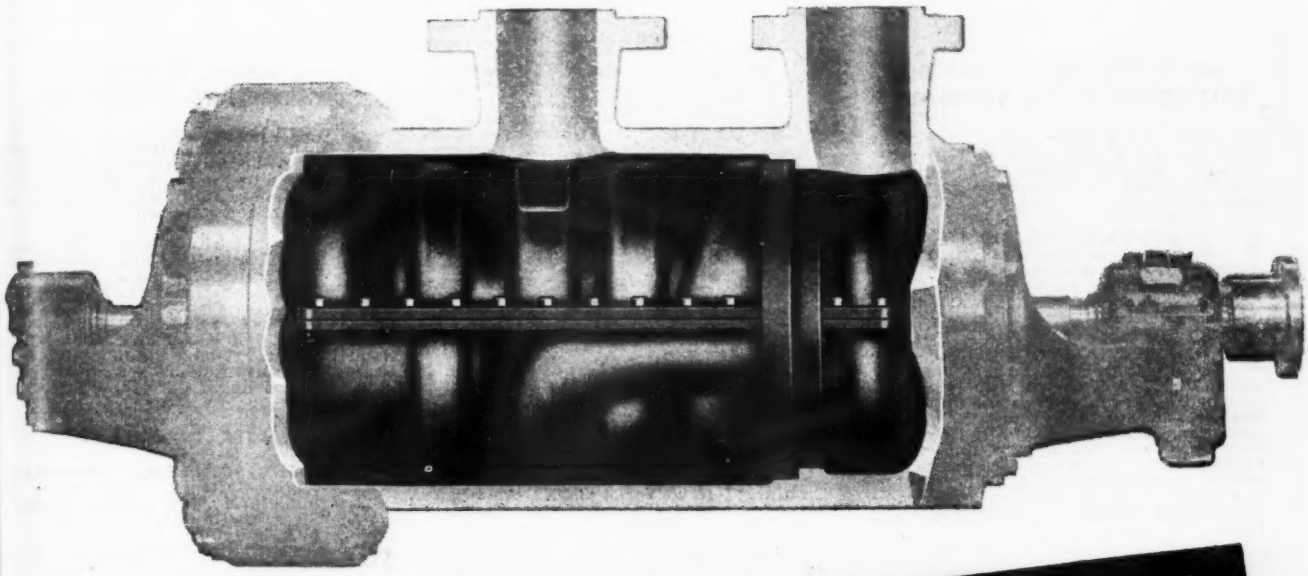
Certain Transformers. Office of War Utilities, WPB, has modified rules governing the placement of purchase orders for certain types of transformers smaller than 250 kva. No longer is it necessary to file applications to purchase transformers of this size and type, except liquid-filled and dry-type power or distribution transformers smaller than 250 kva having special features, design characteristics or accessories as defined in paragraph a, Block 4, Form WPB-2643.

In general, it will not be necessary to file applications for purchase of 3-phase transformers or those with non-standard voltages in smaller sizes. However, applications must be filed for all transformers of 250 kva and larger. Amendment to General Scheduling Order M-293, Table 8, contains the new rules.

Utility buildings construction, formerly restricted by Conservation Order L-41 and by Utilities Orders U-1, U-3 and U-4, is now restricted only by the utilities orders, WPB announces. Change was made by amendment to Order L-41, which eliminates such construction from restrictions of that order. By utility construction is meant any building or group of buildings to be used directly in furnishing electric, gas, water, central steam heating or wire communications services (telephone or telegraph).

(Continued on page 192)

IN BYRON JACKSON HIGH PRESSURE BOILER FEED PUMPS



THE *Design Features* ARE APPARENT

Plain cylindrical outer barrel and end cover are the only parts subjected to tensile stress resulting from discharge pressure; bolted, kept tight or taken apart as easily as any pressure vessel.

The split inner case is subject to compression by discharge pressure exerted by the fluid in the free space between the outer barrel and the inner case. Inner case bolting is for initial tightness only and is lighter for a Boiler Feed Pump of 3000 lbs. pressure than for the average split case cold water pump for 100 lbs.

Rotating element is assembled as a complete unit and dropped into the inner case just as on the simplest split case multi-stage pump. There are no distance sleeves between the impellers and no balancing drum or disc, as the opposed impellers eliminate axial thrust. The element consists only of impellers with their rings and the shaft.

Write for Boiler Feed Pump Bulletin.

CENTRIFUGAL AND TURBINE PUMPS

ARMY E NAVY

BYRON JACKSON CO.

Houston • LOS ANGELES • New York

These NEW Catalogs, Booklets and Bulletins Are Yours for the Asking!

AIR CONDITIONING, HEATING REFRIGERATION AND VENTILATING

1 **OIL BURNERS**—Ray Oil Burner Co, 401 Bernal Ave, San Francisco 12, Cal. 168-page catalog provides factual technical data for selecting or installing heat equipment.

2 **FLAT-SPRAY NOZZLES** — Chain Belt Co, Milwaukee, Wis. 8-page bulletin No. 459 describes Rex flat-spray nozzles for projecting water over all surfaces for cleaning, cooling, washing and descaling operations.

3 **ICE-MAKING EQUIPMENT**—Frick Co, Waynesboro, Pa. 36-page bulletin No. 127-G discusses Brine Race System, submerged shell coolers, pipe coils, dual-pressure plants, group lift, one-man operation, plant design, F-P air system, F-P-R system, framework and covers, tanks, brine agitators, ice cans, can dumps, ice-saver dumps, can fillers, cranes and hoists, tank auxiliaries, ice storages, scoring and vending machines, modernizations.

CONTROLS, MECHANICAL

4 **PRESSURE CONTROLS** — Automatic Control Co, St. Paul 4, Minn. 50-page catalog No. C-4 gives general information and data on remote and static line control by pressure.

5 **TEMPERATURE CONTROL** — Johnson Service Co, Milwaukee 2, Wis. 12-page bulletin No. 396 describes general features of Johnson Electronic Duo-Stat. 16-page bulletin No. 396A covers technical and installation data on the same instrument.

6 **AIR-OPERATED CONTROLLERS**—Britsol Co, Waterbury 91, Conn. 8-page bulletin No. A115 presents Model 93 series for the control of temperature, pressure, vacuum, liquid level, humidity and flow.

ELECTRICAL EQUIPMENT

7 **HEAT LAMPS**—Wabash Appliance Corp, 345 Carroll St, Brooklyn 31, N. Y. Illustrated brochure discusses Birdseye infra-red radiant heat lamps.

8 **INSTRUMENT TRANSFORMERS**—General Electric Co, Schenectady 5, N. Y. 56-page booklet No. GEA-4240, entitled "Instrument Transformer Accuracy Standards," is divided into two parts. First section explains ASA accuracy standards for potential and current transformers and shows how they differ from NEMA standards. Second part consists of a handy guide for selection of standard indoor and outdoor current and potential transformers.

9 **DISTRIBUTION TRANSFORMERS** —Allis-Chalmers Mfg Co, Milwaukee 1, Wis. 4-page bulletin No. B6333 describes expanded line of distribution transformers which withstand complete water submersion.

MAINTENANCE MATERIALS

10 **HEAT-RESISTANT COATINGS**—Preferred Utilities Mfg. Corp, 1860 Broadway, New York 23, N. Y. 1-page bulletin No. 925 discusses White Hot and Pyro-Chrome coatings.

11 **PROTECTIVE COATINGS** — Quigley Co, 527 Fifth Ave, New York 17, N. Y. Triple-A catalog, color card and bulletins cover entire line of Quigley protective coatings.

12 **SKIN CREAMS**—B. F. Goodrich Co, Akron, Ohio. 4-page catalog section No. 12010 describes Clad protective skin creams for wet or dry work.

13 **WATERPROOFING MATERIAL**—Flexrock Co, Filbert and Cuthbert St, Philadelphia 4, Pa. 4-page folder tells how to stop leaks with Flextite without removing water pressure.

14 **FLOOR-SURFACING MATERIAL** —A. C. Horn Co, Long Island City 1, N. Y. 4-page booklet describes Blue Temper Ferem floors for newly constructed buildings, or when patching, resurfacing or relaying worn and eroded floors.

15 **PLASTIC COATINGS** — Amercoat div, American Pipe & Construction Co, Box 3428, Terminal Annex, Los Angeles 54, Cal. 16-page catalog discusses uses of Amercoat, including a list of materials and equipment that are now being protected against corrosion or contamination.

PIPING, FITTINGS VALVES AND SPECIALTIES

16 **WELDING FITTINGS** — Tube Turns, Inc, Louisville, Kentucky. 20-page booklet gives allowable working pressures for welding fittings in five classes of piping—power, oil, district heating, gas and air, and refrigeration.

17 **STEEL TUBING**—Globe Steel Tubes Co, Milwaukee 4, Wis. 24-page bulletin No. 112 lists bursting pressures of seamless tubing from ⅛- to 9⅝-in. OD.

18 **CONDUIT SYSTEMS**—Ric-wil Co, 1572 Union Commerce Bldg, Cleveland 14, Ohio. 12-page catalog No. 44 discusses conduit systems for underground and overhead steam, oil or hot-water lines.

WATER TREATMENT

19 **WATER SOFTENER EQUIPMENT** —Elgin Softener Corp, Elgin, Ill. 8-page bulletin No. 606 presents improved double-check zeolite water softener.

20 **WATER CONDITIONING** — Cochrane Corp, 17th & Allegheny Ave, Philadelphia 32, Pa. 8-page reprint No. 32 describes characteristics of acid regenerated carbonaceous zeolites.

21 **GAS REMOVAL** — Cochrane Corp, 17th & Allegheny Ave, Philadelphia 32, Pa. 4-page publication No. 2975 discusses Cochrane Decarbonators for removing certain dissolved gases from water solution. (*Continued on page* 190)

HOW TO ORDER

Be sure to fill out, completely, one coupon for each piece of literature you order. (See sample below.) This gives your request authority and helps the manufacturer to address your copy completely. Readers who fail to prepare request blanks correctly may be disappointed under difficult postal conditions and limited quantities of bulletins available today.

Use as many coupons as you need, but cut them out and send them as one block in an envelope addressed to POWER, 330 W 42nd St, New York 18, N. Y.

FILL OUT AND SEND TODAY! NOT GOOD AFTER JANUARY 1, 1945.

Write in circle number of item describing one catalog wanted → ( )

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POWER, 330 West 42nd St., New York 18, N. Y. 11/44

Write in circle number of item describing one catalog wanted → (17)

Your Company Name. Brown Mfg Co.

Address 3718 First Avenue

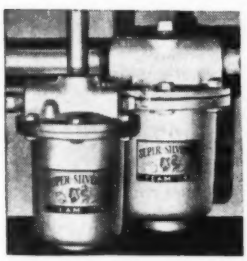
Pottsville, Okla.

Your Name John Smith

Your Title Power Engineer

POWER, 330 West 42nd St., New York

Steam Trap Economy Starts Here



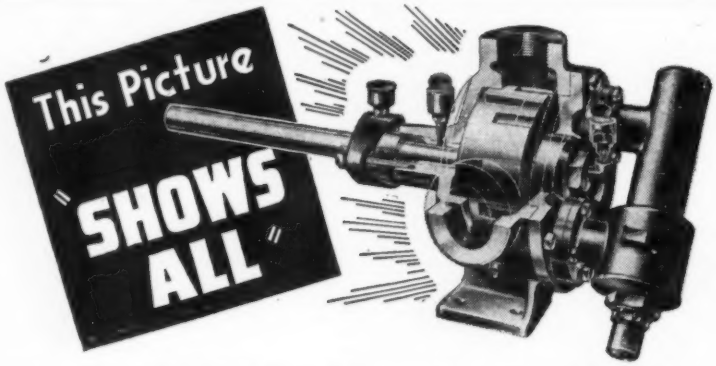
Super-Silvertops can be piped as an elbow or straight-in-line.

True Steam Trap economy starts with the blueprint for installing new steam using equipment. If that plan calls for Super-Silvertop Steam Traps to drain off condensate, and if they are installed, then the owner can expect true Steam Trap economy for years to come. Why? Because the installation brings a saving on fittings . . . Super-Silvertop requires only one, a saving also on labor costs since each trap requires 60 minutes less installation time.

And since this trap can be inspected without removing from the line, hours of labor are saved throughout its years of usefulness. Multiply these economies by the number of traps you install, and the saving over the years is startling . . . You will find other economies and advantages in the free book, "How to Choose a Steam Trap". Write for your copy.

THE V. D. ANDERSON COMPANY
1934 WEST 96th STREET • CLEVELAND 2, OHIO

Super-Silvertop
STEAM TRAPS

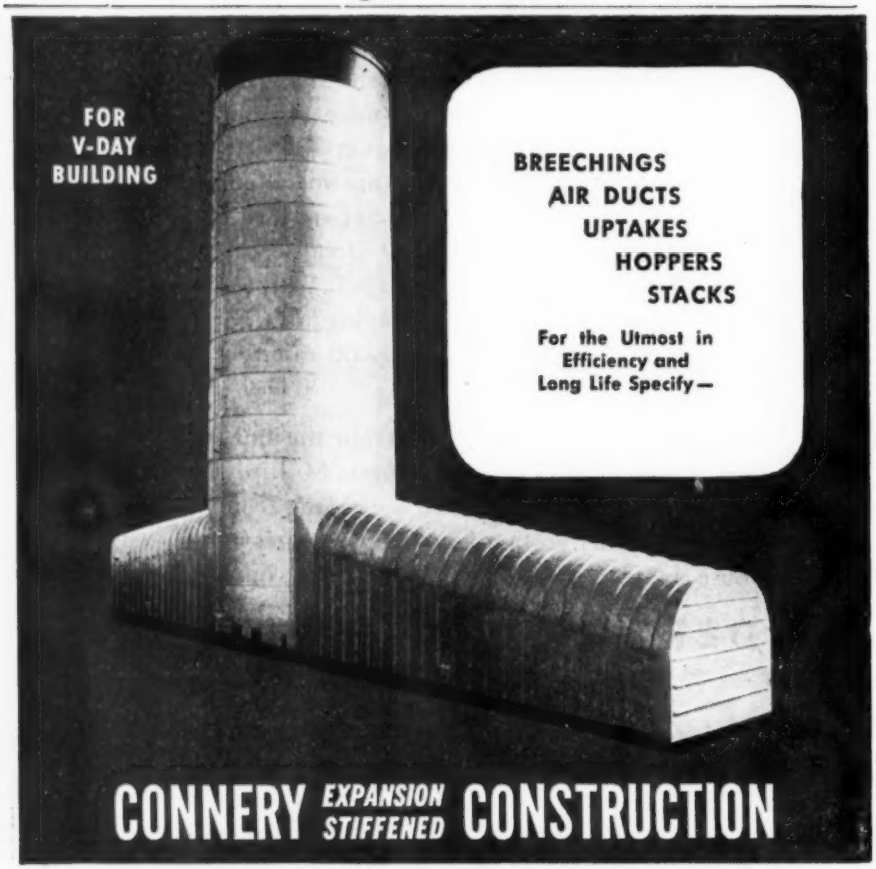


The VIKING Standard Pump

This cut-away illustration reveals the simplicity of design and the extremely sturdy construction of the Viking Standard Pump . . . features that insure dependable, carefree service and that have made Vikings first choice with American industry for every rotary pumping job . . . no matter how tough. The Viking Standard Pump is suitable for suction lifts up to 25 feet, and for heads of 115 feet or 50 pounds pressure. Heavy Duty styles also available up to 200 pounds pressure. Sizes range from 5 to 1050 GPM. Write today for Bulletin Series 800 which describes and illustrates Viking Pumps widely used in the power equipment field. IT'S FREE.

VIKING PUMPS — FIRST IN AMERICA

VIKING Pump COMPANY
CEDAR FALLS, IOWA



CONNERY CONSTRUCTION CO.
SECOND & LUZERNE STS. PHILADELPHIA

New Bulletins

(*Continued from page* 188)

OTHER EQUIPMENT

22 **FLUSHING SYSTEM** — Winslow Engrg Co, 4069 Hollis St, Oakland 8, Cal. 8-page booklet covers the Winslow Giant-Flo flushing system for large turbine-driven reduction-gear propulsion machinery, large diesel engine plants and other heavy-duty machinery.

23 **CARBIDE-TIPPED TOOLS**—Moreland Tool Co, 16935 W McNichols Rd, Detroit 19, Mich. 24-page booklet discusses tool holders, counterbores, countersinks, pilots, driving bars, back spotfacers, cutters, etc.

24 **WIRE ROPE**—Preformed Wire Rope Information Bureau, 520 N Michigan Ave, Chicago 11, Ill. Bulletin, entitled "Wherein We Sleuth Out a Fact or Two About Preformed Wire Rope!" and booklet, entitled "Pertinent to Preformed," give valuable information on subject.

25 **RIGID AND FLEXIBLE COUPLINGS**—Philadelphia Gear Works, Erie Ave & G St, Philadelphia 34, Pa. 20-page bulletin No. 150 describes line of rigid and flexible couplings.

26 **WORM GEAR REDUCTION UNITS** —Cleveland Worm & Gear Co, 3292 E. 80th St, Cleveland 4, Ohio. 4-page bulletin points out advantages of Speedaire fan-cooled worm gear reduction units.

All literature designated with a star (★) may be obtained only by writing direct to the manufacturer on company letterhead, giving writer's name and title.

★ **STEEL FORGING TEMPERATURES**—Steel and tube div, Timken Roller Bearing Co, Canton 6, Ohio. 78-page book contains recommended forging temperatures of 68 steels, as determined by hot twist test conducted by company.

27 **RADIATION PYROMETERS**—Bristol Co, Waterbury 91, Conn. 12-page bulletin No. P1202 gives application, operation and design of Bristol radiation pyrometers.

28 **FLOWMETERS** — Builders-Providence, Inc, Providence, R. I. 8-page bulletin No. 349 describes Shuntflo meters for measuring flow through steam, air or gas lines.

29 **STEAM ENGINES**—Troy Engine & Machine Co, Troy, Pa. 8-page bulletin No. 306 discusses vertical Troy-Engberg steam engines. Sectional drawings are included.

30 **CENTRIFUGAL PUMPS** — Chain Belt Co, 1600 W Bruce St, Milwaukee 4, Wis. 20-page bulletin No. 447 presents Rex Speed Prime pumps, in sizes from 1½ to 8 in., with capacities ranging from 3000 to 125,000 gal. per hr.

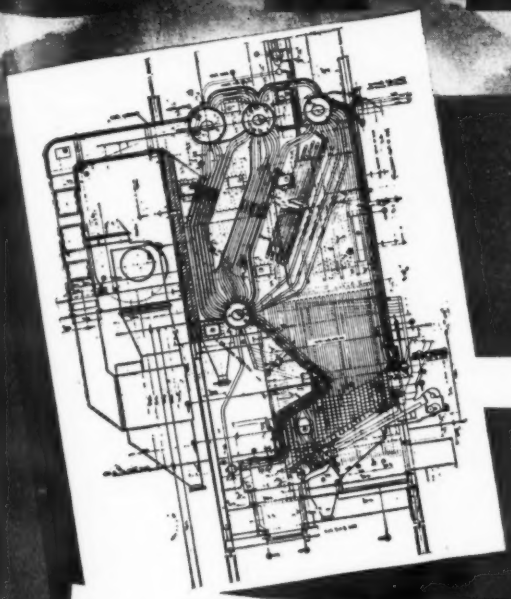
31 **CENTRIFUGAL FIRE PUMPS**—Allis-Chalmers Mfg Co. Milwaukee 1, Wis. 4-page bulletin No. B6336 covers ac single-stage double-suction centrifugal fire pumps for heads from 60 to 108 psi at capacities from 500 to 1500 gpm.

32 **RUBBER PRODUCTS**—B F Goodrich Co, 490 S Main St, Akron, Ohio. 12-page booklet discusses company's line of Vibro-Insulators, molded, extruded, lathe cut and sponge rubber products, rubber-lined tanks and valves, Koroseal products, etc.

33 **VIBRATION CONTROL**—Vibration Control Co, 545 Fifth Ave, New York 17, N. Y. 6-page pamphlet contains data on vibration-proof bases for fans, compressors, pumps, generating sets, industrial machinery and marine equipment.

STEAM

for



POWER

SOUTHERN COLORADO POWER COMPANY
Pueblo, Colo.

90,000 lbs. steam per hour Vogt LE type bent tube boiler with underfeed stoker. Water walls and economizer. Design pressure 525 lbs. Total steam temperature 750 degrees F.

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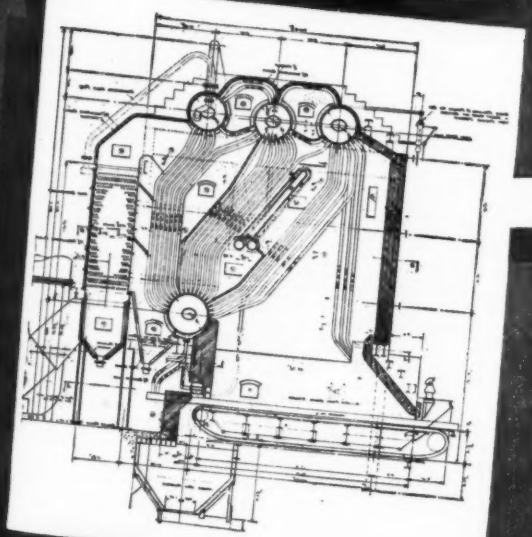

PROCESS

IN A LARGE MID-WESTERN STEEL MILL

Two 105,000 lbs. steam per hour Vogt LE type bent tube boilers with chain grate stokers and economizers. Design pressure 225 lbs. Total steam temperature 550 degrees F.

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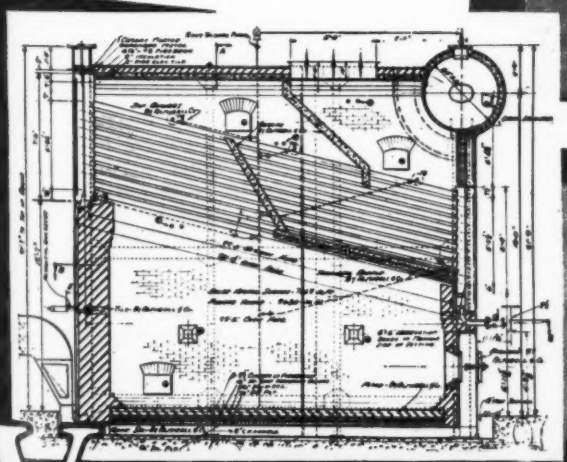


HEATING

CRIMINAL COURTS BUILDING AND JAIL
New York City

Four Vogt sectional header type boilers of 47,000 lbs. steam per hour capacity, oil fired. Design pressure 200 lbs.

HENRY VOGT MACHINE CO.
LOUISVILLE, KENTUCKY
Branch Offices: NEW YORK CLEVELAND
CHICAGO PHILADELPHIA TULSA

Vogt *Water Tube* BOILERS

BENT TUBE AND SECTIONAL HEADER TYPES

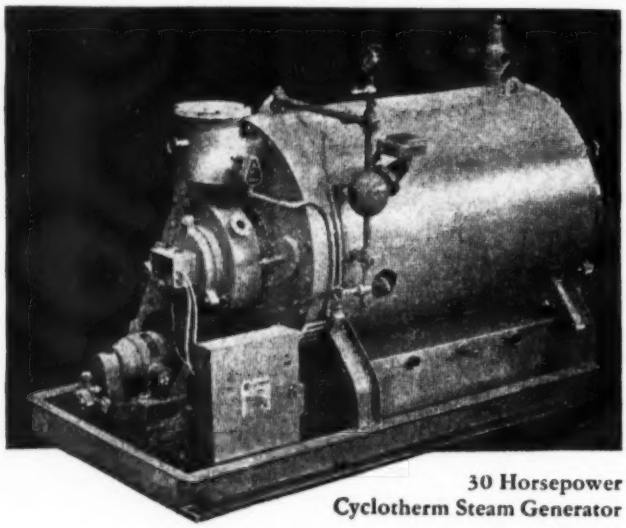
DOLLAR EFFICIENCY—work done per dollar spent—measures the value of steam generation

If you are planning immediate boiler installation or replacement, the efficiency and economy of a Cyclotherm Steam Generator will interest you. While the range of available units obviously cannot be on a peace time basis, Cyclotherm engineers will gladly cooperate in meeting your needs in power, processing or heating with available units.

Cyclotherm meets the dollar efficiency test through a wide power range (10 to 300 horsepower) with both oil and gas fired units. Its exclusive principles of combustion and design have proved Cyclotherm's dollar saving and dollar making capacity under most rigorous operating conditions.

Cyclotherms are fully automatic, sturdily built and completely self contained. They give years of trouble free service with a minimum of attention.

Detailed additional information will be supplied promptly upon request. Our engineers are available for consultation.



30 Horsepower
Cyclotherm Steam Generator

CYCLOTHERM
STEAM GENERATOR

AMES IRON WORKS
OSWEGO . . NEW YORK . . BOX 702

Formerly, all utility construction was controlled by Order L-41, with a $1,000 allowable exemption for construction of any single unit building or group of buildings without WPB approval.

Under the amended order, only sewage-system utility construction is retained in Order L-41, with a $1,000 exemption for any building or group of buildings used directly for a sewage system and owned by a sewage operator, as defined in Order P-141.

John A Roebling's Sons Co Elects Officers

Charles Roebling Tyson has been elected president of John A Roebling's Sons Co, manufacturers of wire products, succeeding the late William A Anderson, who died on September 10, 1944.

Election of Mr. Tyson places in the presidency the grandson of Charles G Roebling, son of the founder, who became president at 28 and served in that capacity from 1877 to 1918. Mr Tyson, who was born in 1914 and attended Princeton University, started with Roebling Co in 1935,

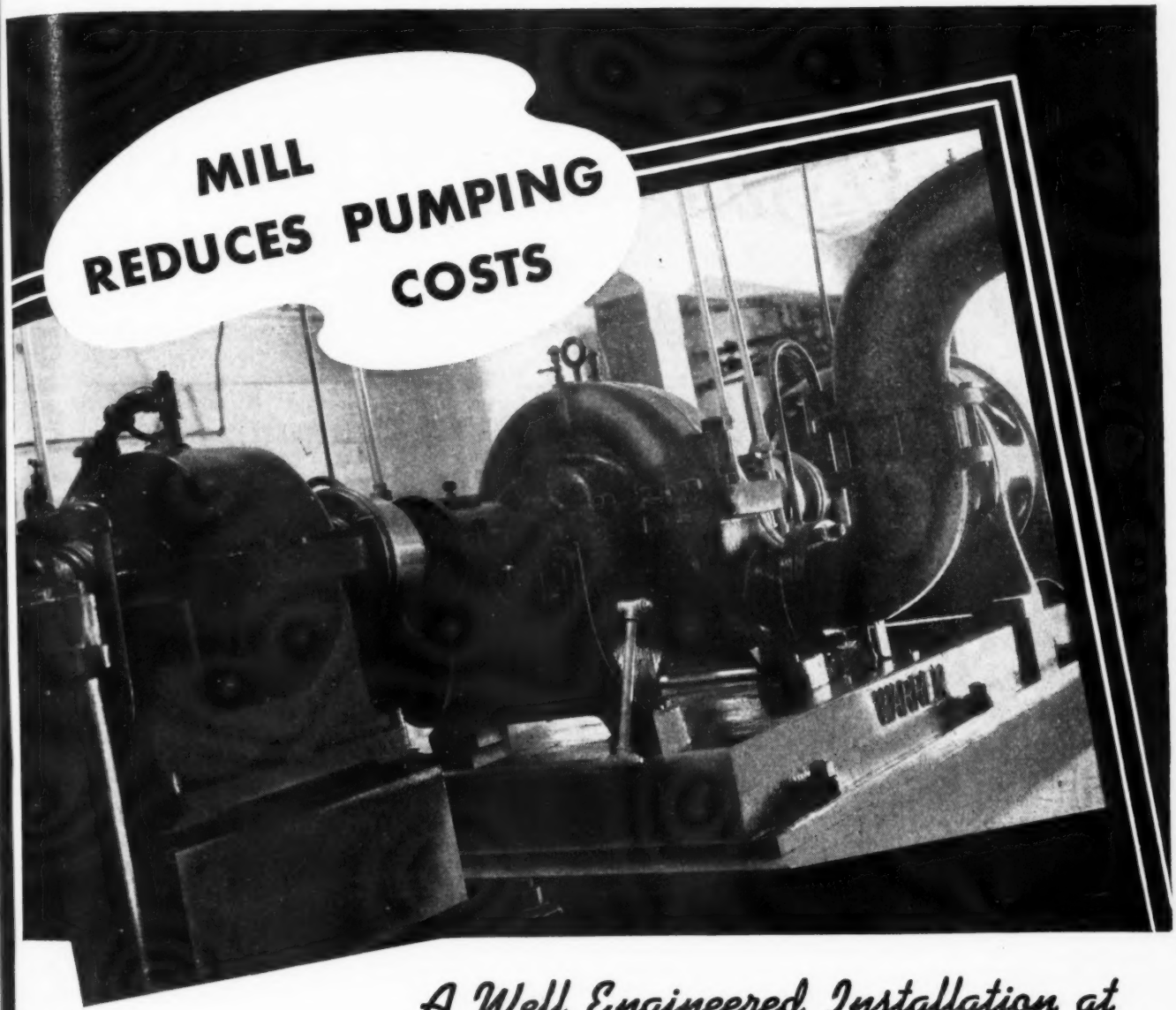
Charles Roebling Tyson

and worked in various manufacturing departments, including the open hearth and wire mills at Roebling, N. J. In 1940, he was made secretary and treasurer.

Election of Lt Joseph M Roebling, now abroad with U. S. Army Air Corps, as chairman of board of directors, was also announced. First vice-president since 1936, he is the son of the late Ferdinand W Roebling, Jr, president from 1926 to 1936. Lt Col F W Roebling, III, U. S. Army Corp of Engineers, another great-grandson of the founder, continues as vice-president.

Also announced was the election of Archibald W Brown, treasurer, and H D Rathbun, secretary and assistant treasurer.

Joseph M Roebling — F W Roebling III



A Well Engineered Installation at

S. D. WARREN COMPANY, manufacturers of quality printing papers, Cumberland Mills, Maine . . .

assisted by a WARREN PUMP

Paper Mills place a premium on reliability and performance. At Cumberland Mills the plant hydraulic elevator pump has a dual drive turbine and synchronous motor.

The turbine driver is used to regulate heat balance and to supply process steam. Pump requirements are thus served with by-product power. The synchronous motor generates when the steam demand exceeds the pump load and operates as a motor when the demand is less. Pump power costs are reduced to a minimum.

In serving industry Warren not only builds pumping machinery for many important and widely diversified services but cooperates with plant engineers and operating executives in working out money-saving installations.

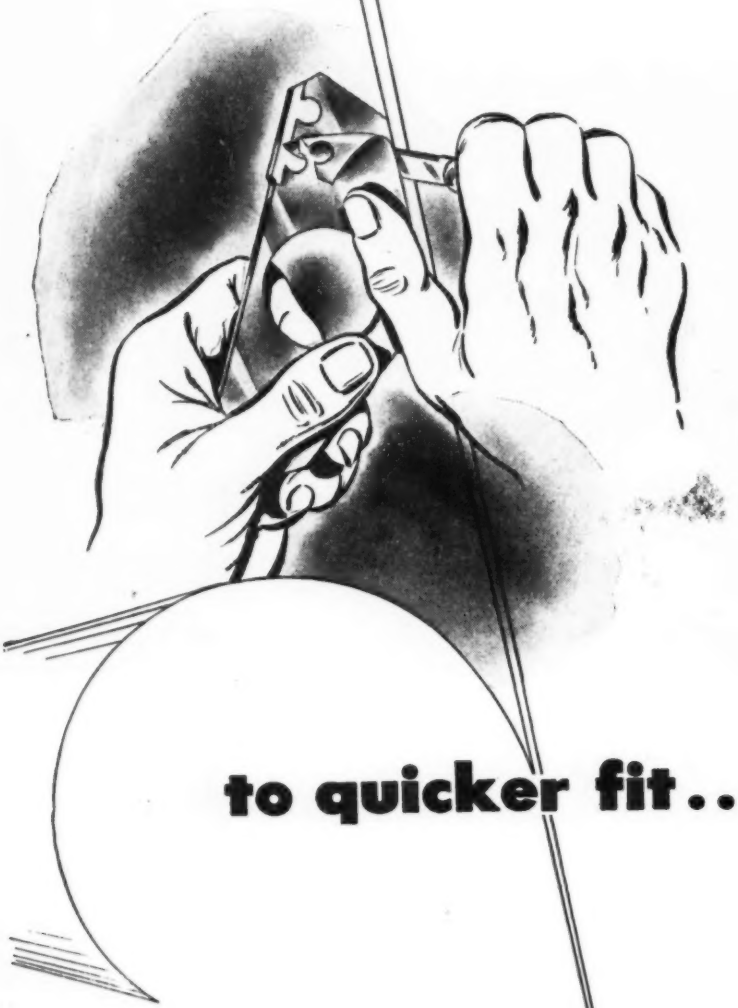
WARREN PUMPS

ARMY E NAVY

WARREN STEAM PUMP CO., INC.

WARREN, MASSACHUSETTS

ADD PRESSURE SEAL



to quicker fit...

THIS MAY BE NEWS to you ... You can get all the advantages of Laminum *plus* the sealing of oil and pressure in bearings ... in *babbitted* Laminum shims. The babbitt lugs are securely locked into the Laminum. Details on request.

Laminum shims are cut to your specifications. For maintenance work, however, shim materials are sold through industrial distributors.

Laminated Shim Company, Incorporated
61 Union Street • Glenbrook, Conn.

LAMINUM
THE SOLID SHIM THAT peels FOR ADJUSTMENT

Control-Room Visibility

(*Continued from page* 82)

generally happens is premature wear. If oil-lubricated bearings are subject to the presence of water, best practice is to use a compounded oil that will form a tacky emulsion resistant to being easily washed out.

Marine engineers employ comparatively heavy bearing oils for reciprocating steam engines. These contain about 20% of rapeseed oil to maintain a tacky emulsion. In paper mills the same practice is often followed on the "wet" end of a paper machine. These are instances where presence of water in the bearings cannot be avoided and the oil runs to waste after passing through the bearings. In splash and circulating systems, one must use an oil that will separate readily from water.

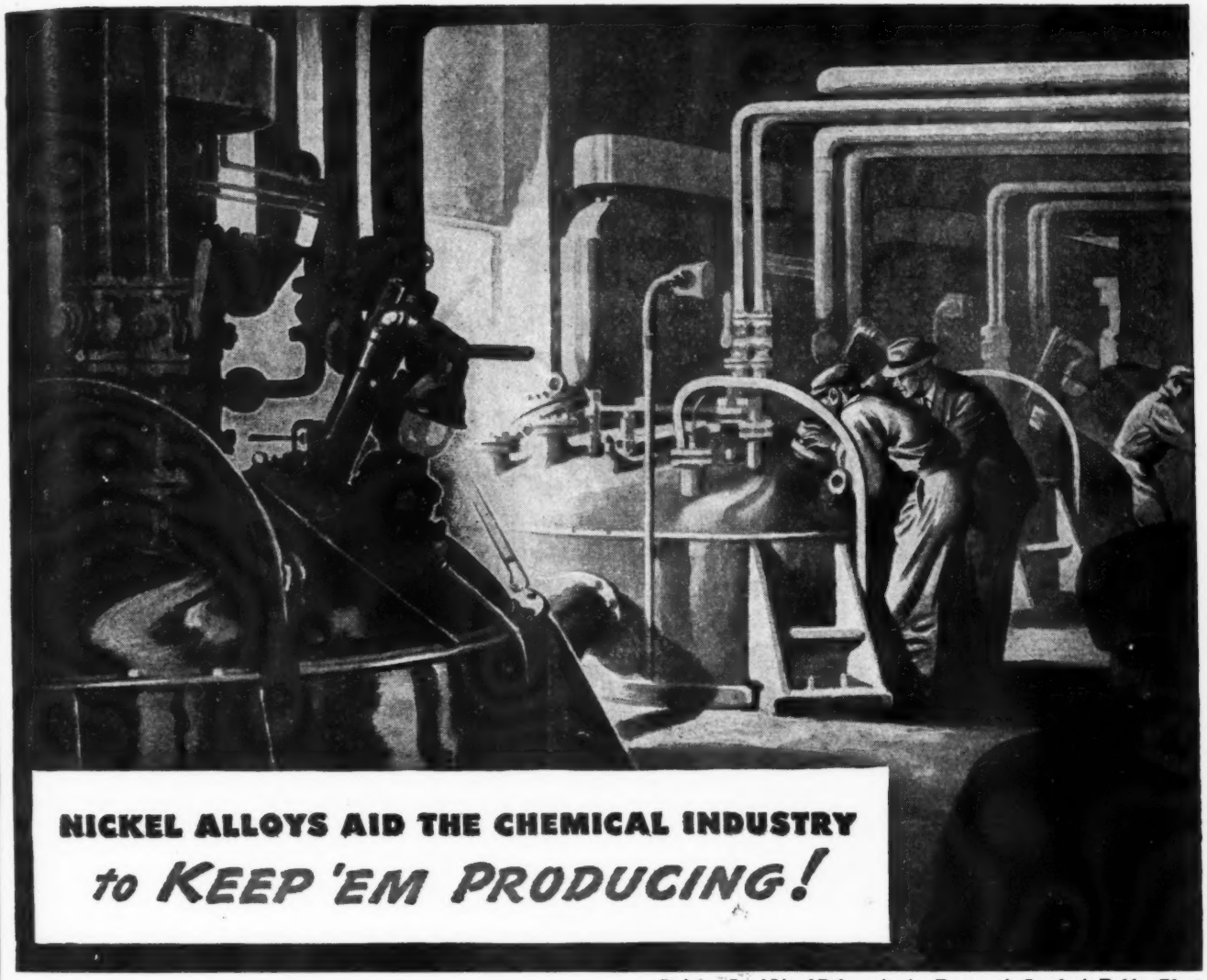
An outstanding example of the careful consideration that should be given lubrication is found in the construction of modern rolling mills. It is standard practice to submit blueprints of mill machinery to experienced lubricating engineers for careful check of all details before the equipment is built and installed. In such mills it is necessary to reduce the factor of safety to a minimum as far as lubricants are concerned and only expert checking of designs avoids recurrent trouble in operation.

The Old Chief

(*Continued from page* 94)

He spoke of the importance of keeping a written record of work done and materials handled: "You have a good story to tell your employer, so make sure that he receives a comparative summary at least once a month." For an hour or more the Old Chief continued to talk of my coming responsibilities in the light of his experience. Finally, he clapped me on the shoulder and mentioned that he might be seeing me later in the evening.

Somewhere around the house, I still have the big gold watch and the gold key to wind it up with. I am told that my grandchildren find it helpful to cut their teeth on. Fashions change in watches and in methods of training engineers, but *service*, *safety* and *loyalty* are still the landmarks of our calling. They have not changed, nor do I think they ever will.



NICKEL ALLOYS AID THE CHEMICAL INDUSTRY to KEEP 'EM PRODUCING!

Stainless Steel Lined Polymerization Reactors in Synthetic Rubber Plant

Equipment of Stainless Steel, Nickel and Monel meets many specialized requirements

Chemical engineers have met America's wartime challenge.

They opened the gates to a mighty flood of products going to war... strategic raw materials, synthetic substitutes, and entirely new substances having advantages all their own.

A factor in this production success is the wide use of stainless steel, Monel, and other corrosion-resistant alloys containing Nickel.

For in the chemical industry corrosion is a large-scale menace.

To wage war on this enemy, chemical engineers enlisted the aid of Nickel, because Nickel imparts to other metals strength and resistance to corrosion and wear. In the chemical field, as in many others, a little Nickel goes a long way to keep equipment producing.

It prolongs the life of processing apparatus, and protects the purity, color, and uniformity of the product.

Hence, stainless and Nickel alloys are specified widely for acid heaters and caustic coolers, for high-pressure autoclaves and vacuum evaporators, for cracking towers and polymerization reactors, for shipping drums and tank cars, for pumps, piping and storage tanks, for agitators and settlers, for stills and digestors—for every type of equipment that converts laboratory experiments into full-scale chemical operations.

For years we have enjoyed the privilege of cooperating with technical men of the chemical industry... and of many others. Whatever your industry may be ... if you want help in the selection, fabrication, and heat treatment of alloys ... we offer you counsel and data.

New Catalog Index

New Catalog C makes it easy for you to get Nickel literature. It gives you capsule synopses of booklets and bulletins on a wide variety of subjects—from industrial applications to metallurgical data and working instructions. Why not send for your copy of Catalog C today?

* Nickel *

THE INTERNATIONAL NICKEL COMPANY, INC., *67 Wall St., New York 5, N. Y.*

DARTS HAVE

A lot of unions look alike. Darts look different because they are different—*they have two bronze seats ground to a true ball joint.*

That means they *act* differently also.

They close perfectly—to *stay* closed; but open readily, if needed, to be used over and over again, and Dart's bodies and nuts are made of air-refined malleable iron. That's why economy-wise buyers *insist* on Darts.

Be sure your supplier sends Darts.

DART UNIONS

E. M. DART MFG. CO. **PROVIDENCE 5, R. I.**

Begin Unit Work

The War Production Board has authorized resumption of construction work on the $45,000,000 Southwark generating station of Philadelphia Electric Co.

Only one of the two 150,000-kw generating units is to be installed now. The completed work, in the fall of 1946, will represent an estimated $30,000,000. The station's ultimate capacity is designed to be 600,000 kw, an addition sufficient to take care of nearly two million homes.

Authorization permits installation of the 150,000-kw turbo-generator, a 12,500-kw auxiliary turbo-generator and two boilers. Also included is erection of outdoor substation 66-kv underground transmission cables to the company's Schuylkill and Westmoreland substations and necessary receiving apparatus at latter locations.

OBITUARIES

J L Lawrence, 68, died on Aug 15 following a heart attack. He was traveling engineer of Northern States Power Co, Minneapolis.

J Thomas Richardson, for 20 years with Virginia Electric and Power Co, died Aug 10. He was 50 years old.

Dwight L Armstrong, 50, vice-president of Armstrong Cork Co, died Sept 10, after an illness of four weeks.

Rupert K Stockwell, 62, died Aug 24 of a heart attack. He was in charge of Pacific Coast sales for Robins Conveyors.

Frank H Reagan, board chairman of Locke Insulator Corp, died suddenly on Sept. 10, at the age of 72.

P E Herman, 75, retired salesman of Monsanto Chemical Co's organic division, died on Sept 23 after a long illness.

HALF OF EVERY TREE CUT GOES TO WAR

America is shipping ten times as much tonnage overseas in this war as in 1917-1918. That wood—as packaging lumber, cartons, boxes—is expended in battle—it is gone. It can be replaced only by *you*, or by manpower drawn from war production to cut more trees.

Every pound of paper you save today represents manpower saved in cutting, hauling, shredding. Save every scrap for the big scrap we have got to win.

Ranking beside war bonds and blood donations is this job that anybody can do—saving the paper that our mills must have to package our fighting supplies.

PAPER SAVED TODAY WILL FIGHT FOR YOU TOMORROW

CLOSE UP OF DEAERATOR SHOWING VENT CONDENSER

SIDE VIEW, ONE OF MAIN DEAERATORS

It takes *Power*

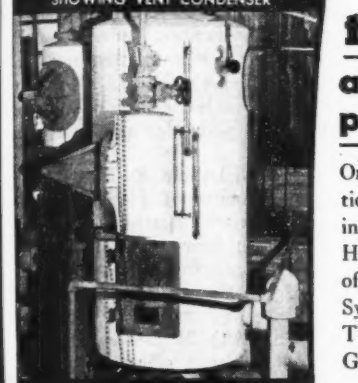
to make Synthetic Rubber

and COCHRANE equipment to help produce that POWER efficiently

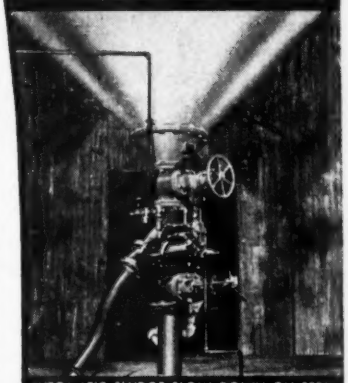
One of the most important plants in North America for the production of synthetic rubber has a power plant that is the last word in modern equipment. Among its important features are Cochrane Hot Process Water Softeners, with Cochrane Flow Meter control of acid feed, Cochrane Deaerators, Cochrane Continuous Blow-Off System, Cochrane Filters and Cochrane Multiport Relief Valves. The softeners consist of two units each with a capacity of 100,000 GPH. The softened water is filtered through 8 horizontal filters.

Acid proportioning is operated by a Cochrane flow meter, increase or decrease in flow causing a change in flow of acid. The softened and filtered water is deaerated in two Cochrane Deaerators, each with a capacity of 800,000 lbs. per hour. Another Cochrane Deaerator deaerates the water supply for the desuperheaters. A Cochrane continuous blow-off system is also installed, and Cochrane Multiport Relief Valves on the main exhaust header.

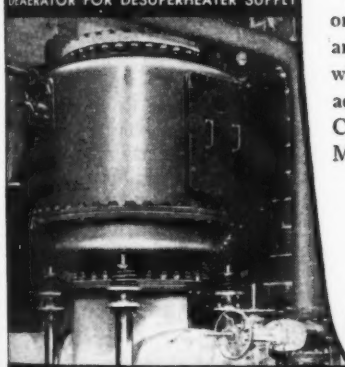
A complete description of this installation mailed on request.

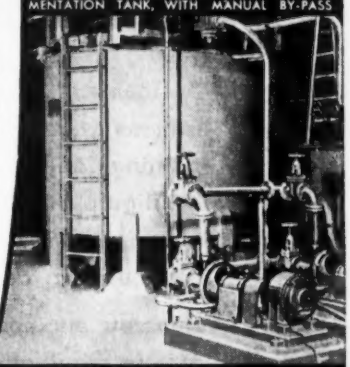


DEAERATOR FOR DESUPERHEATER SUPPLY



AUTOMATIC SLUDGE BLOW DOWN ON SEDIMENTATION TANK, WITH MANUAL BY-PASS





MAIN CONTROL PANEL FOR LIME, SODA ASH, SULPHURIC ACID, AND PHOSPHATE FEEDS, ALSO COMPLETE ALARM SYSTEM

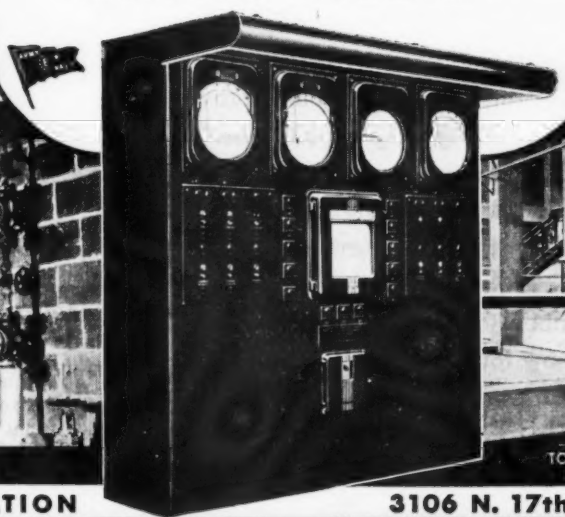
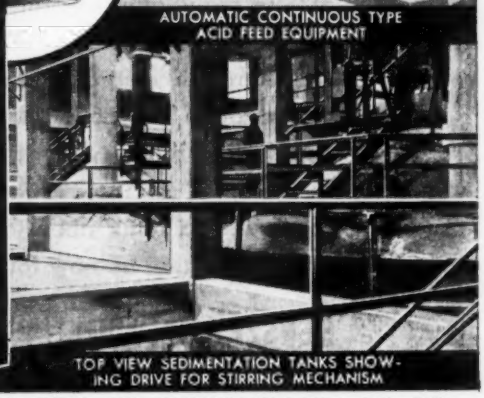


FIG. 1000 COCHRANE MULTIPORT RELIEF VALVE ON MAIN EXHAUST HEADER

FLO-CONTROL VALVE FOR CONTINUOUS BLOW-OFF SYSTEM

AUTOMATIC CONTINUOUS TYPE ACID FEED EQUIPMENT



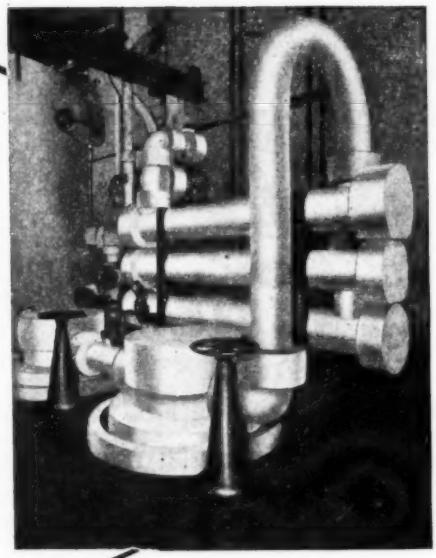
TOP VIEW SEDIMENTATION TANKS SHOWING DRIVE FOR STIRRING MECHANISM

COCHRANE CORPORATION — **3106 N. 17th ST., PHILADELPHIA 32, PA.**

COCHRANE

SOFTENERS • DEAERATING SOFTENERS • DEAERATORS • METERS • STEAM SPECIALTIES

The HEART of EFFICIENT BOILER OPERATION



HENSZEY *Continuous Blowdown*

A Henszey system will keep boiler water concentrations within safe margins—preventing foaming, priming, and the formation of sludge and scale (with proper chemical treatment). This absolute control of boiler water concentration is accomplished continuously, automatically and without heat loss.

Henszey engineers will gladly make an analysis of your plant, offering practical suggestions to prove what savings can be made by proper boiler water concentration control. Remember that while fuel conservation and boiler efficiency are now patriotic necessities, fuel savings and lower manpower requirements point to lower costs of production—something to think about and plan for in the near future. Contact us now for details.

HENSZEY CO. Dept. D-11 Watertown, Wis.

HENSZEY

CONTINUOUS BLOWDOWN

Flow Indicators • Distillation Systems • Heat Exchangers
Feed Water Meters • Boiler Feed Regulators • Proportioning Valves

APPOINTMENTS

Ross Heater & Mfg Co establishes factory office at 901 Citizens State Bank Bldg, Houston 2, Texas, with **John A Coleman** as manager . . . **Lucien W Moore** has been appointed manager of valve and fitting sales department, **Crane Co**, with headquarters at general offices in Chicago. **Thomas J Hanlon** succeeds him as purchasing agent . . . **Jenkins Bros** elects **James L Dunn** vice-president in charge of industrial relations . . . **Tube Turns, Inc,** announces appointment of **Ches Herndon** as manager of Houston branch, with offices in Commerce Bldg . . . **Llewellyn W Jones** has retired as treasurer of Grinnell Corp, but will continue to act as director, member of executive committee of board and as financial advisor. **C H Rison,** formerly assistant treasurer, has been elected treasurer . . . **Kennedy Valve Mfg Co** has named **Leon H Marsh** as vice-president and sales manager.

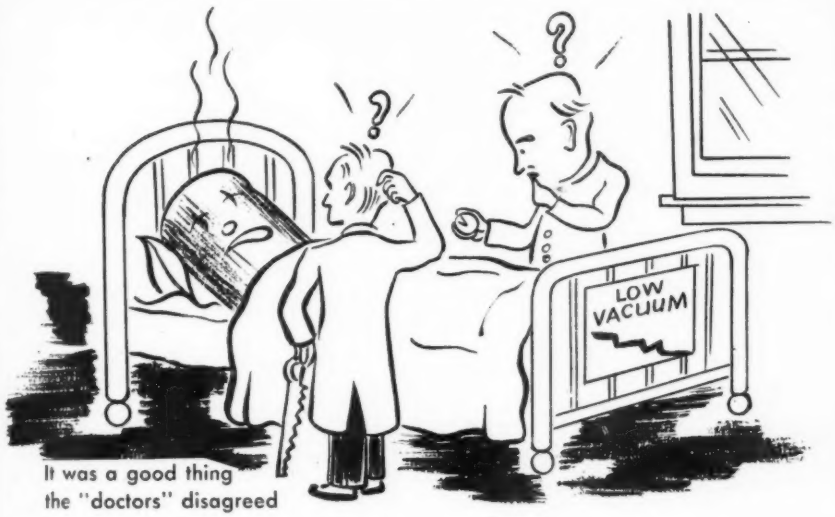
Westinghouse Electric & Mfg Co announces appointment of **J H Jewell** as manager of industry departments and **Edwin L Ehret** has been made district engineer of southwestern district of lamp division. **B M Brown** has been named manager of petroleum and chemical section, succeeding **Q M Crater,** who was transferred to Detroit office of industrial department as assistant manager. **William A Minkler** has been appointed air-conditioning application manager of **Westinghouse Elevator Co.**

Ward Leonard Electric Co names **Leonard Kebler** chairman of board of directors. **Dawson J Burns,** formerly vice-president, was elected to succeed Mr. Kebler as president. **Arthur A Berard** was elevated to executive vice-president and general manager and **Frank G Logan** was elected vice-president and manager of research and development. **Ken Hathaway** has been appointed manager of radio distributor division.

Walter H Ridley joins main office of **Foxboro Co** sales promotion department . . . **D A Roehm** is new advertising manager of switch and panel division of **Square D Co,** succeeding John H Varnum . . . **Republic Flow Meters** announces appointment of **Merrill Berkley,** 742 S Hill St, Los Angeles, as its exclusive representative in southern California and portions of Nevada and Arizona . . . **Allen-Bradley Co** adds **Frank D Popowics** as sales engineer to New York staff and appoints **Charles M McCoombs** as assistant to Boston district manager . . . **Cutler-Hammer, Inc,** announces appointment of **J M Cook** as manager of San Francisco district sales office.

G A Wieber has joined central station divisions, **General Electric,** and will devote his efforts to the company's forthcoming "More Power to America" program. It is a comprehensive, practical plan, nationwide in scope, to assist electric light and power industry in rebuilding the power load in immediate postwar era. **Christian Steenstrup** has requested to be relieved of his responsibility as engineer in charge of refrigeration engineering

Ailing Vacuum Cured by REMOVING 20% of the Condenser Tubes



It was a good thing the "doctors" disagreed

THE operators of a large dredge were troubled by low vacuum. The consensus of opinion was that a larger condenser was required, and the operators were reconciled to this eventual necessity. Our engineer, who was called in to quote on some retubing work, suggested that a modification of the existing condenser would increase the vaccum.

We got the job. After removing over 20% of the tubes and making a minor change, the desired vacuum was obtained, and the dredge has been fit as a fiddle ever since.

Why not have a Conseco overhaul to guard against untimely condenser trouble—while the unit is down for a general checkup? Condenser Service has the men, the know-how, and facilities to recondition your condenser quickly and thoroughly. We work every day in the year, around the clock. Don't hestiate to call us any hour, day or night.

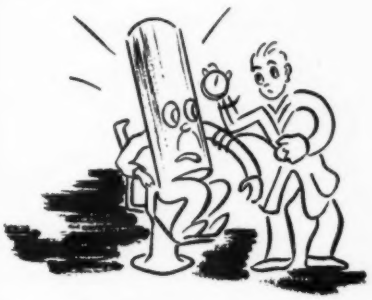
Condenser DO's and DON'Ts

Stop Air Erosion—

Air in circulating water destroys tube ends and tube sheets. A Conseco Air and Erosion Eliminator, with removable screen plates and air ejection piping, will stop this trouble forever. Tube and tube sheet life increased at least three times.

Eliminate Weak Tubes—

Frequently, less than 10% of tubes in large condensers require replacement, but, unless discovered and removed, they will soon necessitate another shutdown and even major overhaul. Even a complete retube job doesn't assure you against trouble, because one of the new tubes may prove defective. For 10 years, the Conseco Hydro-dynamic Shock Tester has eliminated all guesswork about tubes by destroying those ready to fail anyway. If a tube passes our test, it must be good.



Stop Tube End Erosion—

Use FLOWRITES, replaceable, inexpensive belled-end inserts for entrance ends of new or old tubes. They provide smooth, directed flow of circulating water, and prevent air-induced erosion of tube ends. Venturi effect reduces friction from 10 to 84%.

Stop Tube Leaks—

Fast—Conseco Wizard Injector and Sealing Compound stops leaks almost instantly. Inexpensive. Easily installed.

Don't Scrap Tubes with Worn Ends—

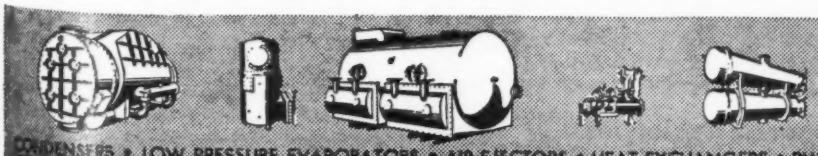
If they pass our shock test, we can stretch them to usable length, cut off the worn ends and return them to useful service.

A highly skilled, specially equipped service organization, ready for immediate action anywhere on the continent, backed by engineering and manufacturing facilities producing over 3,000,000 sq. ft. of heat exchangers annually.

SERVICE

CONDENSER SERVICE & ENGINEERING CO., INC.

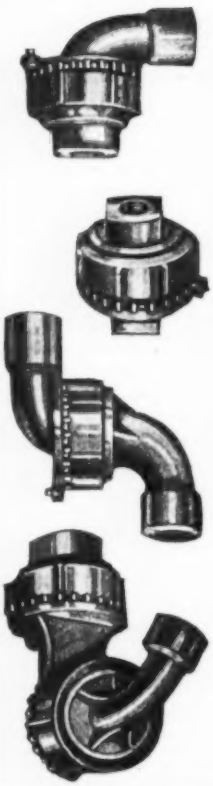
81 RIVER ST., HOBOKEN, N. J. Phone—HOboken 3-4425 After 6 P.M. or Sundays—HOboken 3-4428



CONDENSERS • LOW PRESSURE EVAPORATORS • AIR EJECTORS • HEAT EXCHANGERS • PUMPS

TUBE CLEANING GUNS AND PLUGS
AIR AND EROSION ELIMINATORS
BEVEL GEAR UNIVERSAL JOINTS
STRAINERS, GREASE EXTRACTORS
WIZARD INJECTORS, FILTERS

FLEXO JOINTS



—are used wherever a flexible or swing pipe joint is required for conveying steam, compressed air, water, oil and other fluids under high or low pressure.

Standard FLEXO JOINTS are made of bronze and designed for working steam pressures up to 250 lbs. and temperatures not exceeding 500° F. For temperatures above 500° F and steam pressures up to 1350 lbs. FLEXO JOINTS are furnished of cast steel.

Simplicity is one of the outstanding features as there are no springs to lose or ground surfaces to wear. FLEXO JOINTS will swivel through 360°, yet there is no restriction of the flow of fluid through the fitting. There is a full pipe area in all positions.

Any desired pipe line flexibility can be obtained by using a combination of the several styles of FLEXO JOINTS—illustrated at left. Install them in pipe lines that are moved or swung in different directions or on machinery or equipment that must be supplied with any fluid while in motion.

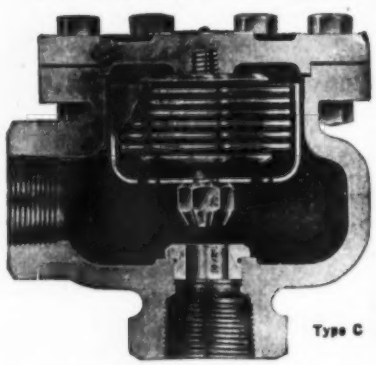
Sizes—¼ inch up to 3 inches, standard iron pipe threads.

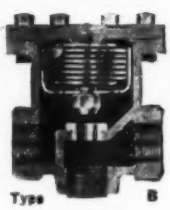
Order from your regular supply house or direct from

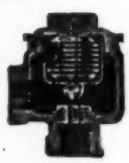
FLEXO SUPPLY CO., INC.
4224 Olive Str. St. Louis, (8) Mo.
In Canada
S. A. ARMSTRONG LTD.
115 Dupont Str. Toronto (5)

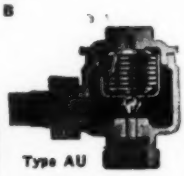
FLEXO

WHAT OTHER TRAP *offers ALL of these features*









NO AIR-BINDING—Discharge air as efficiently as water . . . NO FREEZE-UPS—Drain when cold . . . NO ADJUSTMENT, for any pressure . . . NO WATER-LOGGING—A few degrees temperature differential opens valve . . . NO DRIBBLING—Close immediately when steam contacts bellows.

5 Types of Nicholson Industrial Thermostatic Steam Traps

Sizes ¼" to 2". 2 to 6 times greater valve area and discharge capacity. Pressures to 225 lbs. Write NOW for Bulletin No. 843 . . . See Our Catalog in Sweet's.

W. H. NICHOLSON & CO. 125 OREGON ST. WILKES-BARRE, PA.

Valves • Traps • Steam Specialties

division of GE, but will continue as consultant, **D F Newman,** formerly assistant engineer, succeeds Mr. Steenstrup and **L W Atchison,** formerly designing engineer, becomes assistant engineer.

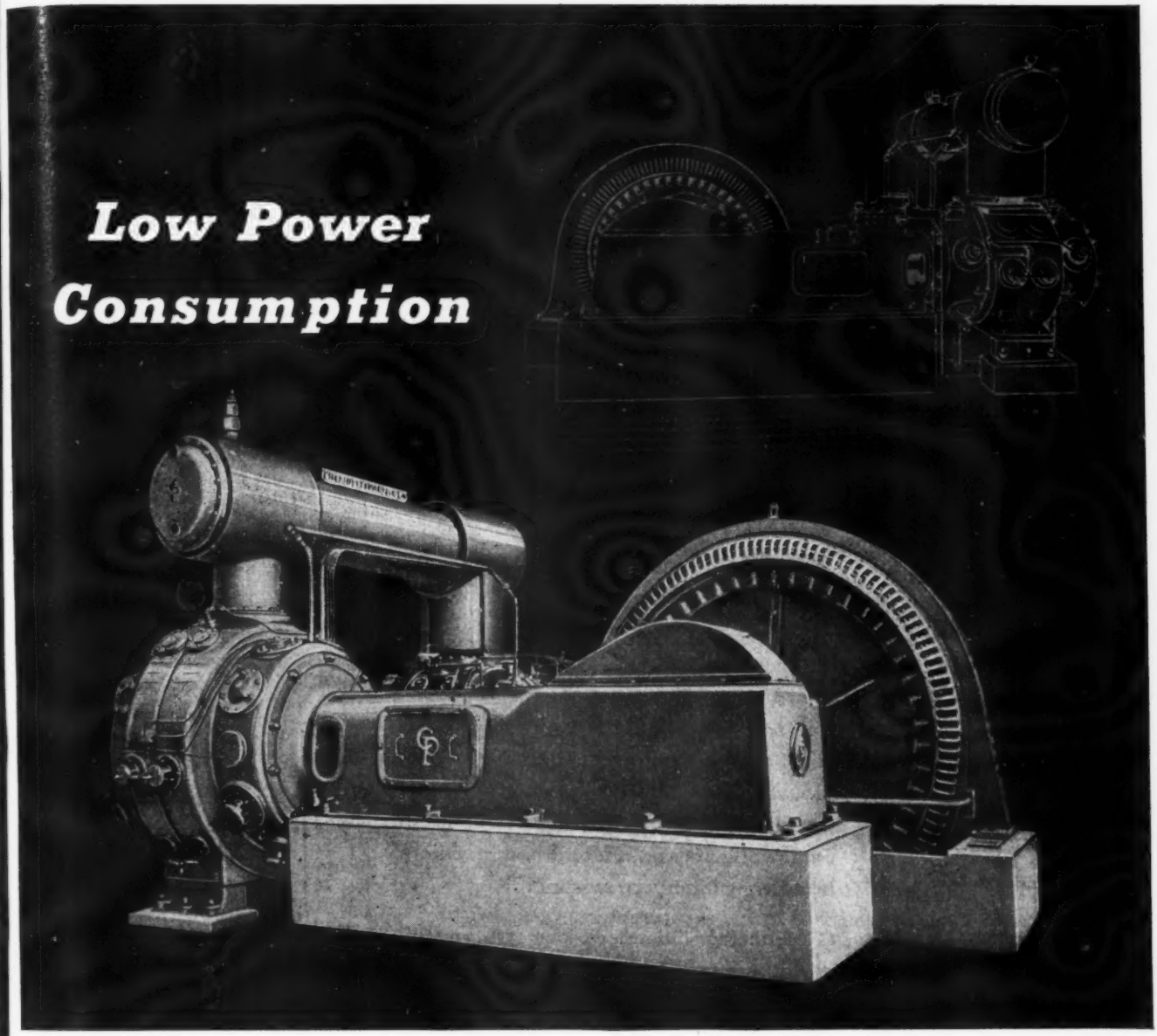
I-T-E Circuit Breaker Co names **Harry L Buck,** formerly marine application engineer, as assistant to president . . . **Fairchild Camera & Instrument Corp** has made **Russell H Lasche** director of engineering and research . . . **Allis-Chalmers Mfg Co** appoints **Hugo W Liebert,** general works manager of tractor plants, **Fred S Mackey,** general works manager of general machinery plants and **Harry E Ladwig,** works manager of West Allis foundries and pattern shops. **Frank C Angle** has been promoted to manager of all Allis-Chalmers field sales offices of general machinery division and their operations. He will continue to supervise operation of Pacific region.

E D Almy replaces A J M Baker as general manager and **Edgar C Brandt** has been made assistant general manager of **Crocker Wheeler Electric Mfg Co,** Ampere, N. J., division of **Joshua Hendy Iron Works.** Capt Almy was assistant general manager of company in headquarters office at Sunnyvale, Calif. Promotions at Sunnyvale plant include **Harry C Gunetti** as assistant general manager, **Robert Mann** as general superintendent and **Clifford Sayer** as assistant general superintendent . . . **Thomas A Edison, Inc,** appoints **Andrew Anderson** engineering manager for special products division. Instrument division of company has named **Carl H Odell** as assistant manager.

Detroit Stoker announces appointment of following district office managers: **Elmer A Kaiser** at Cincinnati, **John L Bainbridge** at Philadelphia and **W P Jones** in Buffalo . . . Board of directors of **American Engrg Co** elected **Thurlow E McBride** as vice-president and treasurer . . . **F Jerome Tone, Jr** was made vice-president in charge of sales of **Carborundum Co,** succeeding **Charles Knupfer,** who has been assigned to special sales and executive activities. Vice-President **Henry P Kirchner** is to be in charge of production and **Otis Hutchins** has been named technical director.

George A Mann will direct new branch sales and engineering office of **Refractory & Insulation Corp** at 2235 Wood St, Philadelphia . . . **Philip Carey Mfg Co** appoints **Harold D Bates** as advertising and sales promotion manager. **Chester L Owens** has been named assistant general sales manager, formerly manager of Cincinnati branch. **George B Johnston,** who becomes general merchandising manager, was previously manager of marketing division . . . **Struthers Wells Corp** announces appointment of **John R Collette** as manager of new heating boiler division, to be operated as part of Titusville boiler division of company.

Worthington Pump & Machinery Corp appoints **William J Van Vleck,** formerly Philadelphia assistant office manager, manager of Atlanta office, succeeding Edward



BUILT INTO CP CLASS O-CE COMPRESSOR

THE low power consumption of the heavy-duty Chicago Pneumatic Class O-CE Compressor is the result of large area, durable, quick-acting Simplate valves . . . streamlined air passages . . . multi-step capacity regulation . . . thoroughly effective intercooling and water jacketing and efficient lubrication.

CP Class O-CE Compressor is of the horizontal, double-acting, water-cooled type with direct-mounted synchronous motor drive. Capacities range from 350 c.f.m. to 10,000 c.f.m., 80 pounds to 125 pounds pressure. Other sizes available for lower and higher pressures and for other types of drive. Write for Bulletin 726.

★★★★★★★★★
PNEUMATIC TOOLS
ELECTRIC TOOLS
HYDRAULIC TOOLS
ROCK DRILLS

CHICAGO PNEUMATIC
TOOL COMPANY
General Offices: 8 East 44th Street, New York 17, N. Y.

★★★★★★★★★
AIR COMPRESSORS
VACUUM PUMPS
DIESEL ENGINES
AVIATION ACCESSORIES

Look at the INSIDE STRANDS *when you buy* PACKING

Ordinary packings are merely dipped in lubricant after braiding, plaiting or twisting. The result . . . such packings soon lose their lubricating quality, dry out, and score the rod, shaft or stem.

Not so with PALMETTO and the other G-T Self-Lubricating Packings. *Each individual strand* of these packings is separately impregnated by a special lubricant, while hot and under pressure, *before* braiding, plaiting or twisting.

G-T Packings, therefore, come to you literally *saturated* with lubricant. That's why these packings remain soft and pliable for long periods . . . protect shafts, rods and stems . . . reduce annual packing expenditures and stuffing box maintenance costs. You are SAFE when you buy G-T Packings, and there's an exactly suitable style for every fluid.

8 REASONS for the Superiority of G-T Packings

1. SIMPLE LINE . . . makes correct selection easy
2. COMPLETE LINE . . . an exactly suitable type for every service.
3. SELF LUBRICATING . . . each individual strand saturated with lubricant
4. SPECIAL LUBRICANTS . . . lubricant for each service specially compounded in our own plant
5. SELECTED YARNS . . . provide tensile strength and resist high temperature
6. CONSTRUCTION . . . assures maximum endurance, longest life, lowest friction
7. EXPERIENCE . . . 80 years of manufacturing experience
8. PERFORMANCE . . . proven in thousands of plants of every type

Write for Literature

GREENE, TWEED & CO.

Bronx Blvd. at 238 St. New York 66, N. Y.

PLANTS: New York, N. Y. and North Wales, Pa.

PALMETTO *for steam, hot water, air.* PALCO *for water.* PELRO *for oils.* CUTNO *for alkalis.* SUPERCUTNO *for acids.* KLERO *for foods, etc.* PALMETTO SUPERSHEAT **PACKINGS**

G-T *self-lubricating* **PACKINGS**

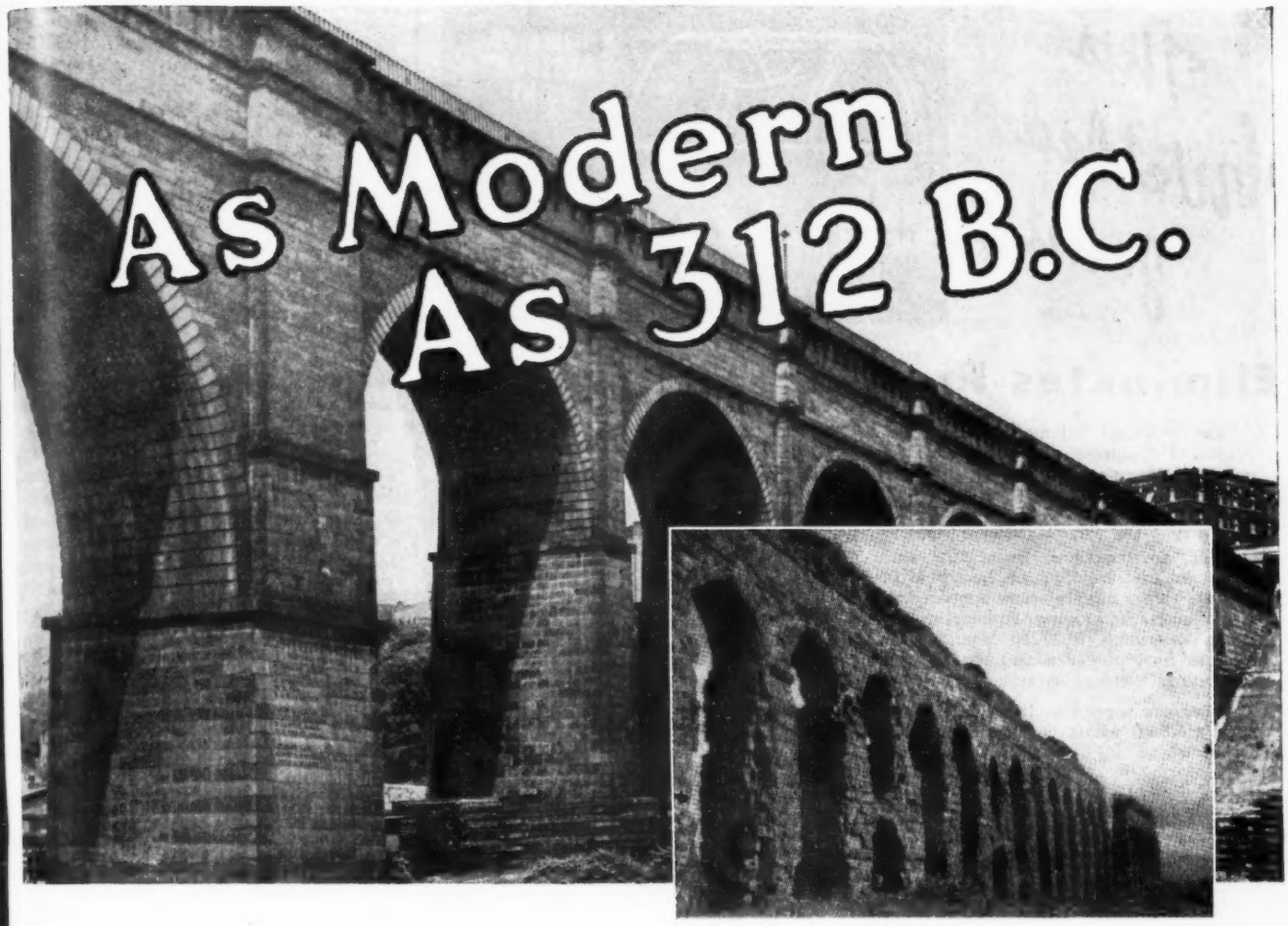
Stauverman. **C W Camp** joins Worthington as consulting electrical engineer, replacing the late Harry Wood . . . **Milton Roy Pumps** announces appointment of **W K Sims,** 24 Commerce St, Newark, as representative for Northern New Jersey territory; **George P Schumacker,** 1120 Chester Ave, Cleveland, representative for Cleveland and northeastern Ohio; **J J Heinrikson,** 421 B M A Bldg, Kansas City, representative for Omaha, Nebraska, Western Missouri and all of Kansas; and **Charles Holz** of Industrial Equipment Co, Charleston, for West Virginia territory . . . **Economy Pumps** has elected **E E Quimby** to position of commercial vice-president, specializing in sales transactions for large projects which are too involved for a resale agency, such as flood control work, etc. He will continue his active connection with **Quimby-Ryan** in addition to his new relation with Economy.

Farrel-Birmingham Co has made **R C Wilson** sales manager of Buffalo division . . . **William B Mercer** handles sales again for **Robins Conveyors, Inc,** at Boston office . . . **Timken Roller Bearing Co** announces appointment of **Howard C Sauer** as general manager of new foreign division, with offices at Canton, Ohio . . . **Littleton C Barkley** has been promoted to sales manager of mechanical rubber goods sales department of **Manhattan rubber mfg division** of Raybestos-Manhattan . . . **Mechanical Handling Systems, Inc,** appoints **J F O'Hora** as manager of new office at 1224 Commercial Trust Bldg, Philadelphia . . . **Raymond A White, Jr,** newly appointed president of **Beaumont Birch Co,** announces election of company officials as a result of death of **H E Birch,** former president. **George T Birch** will continue as vice-president and treasurer, in addition to acting as chairman of board; **Florence L Birch** will act as secretary; and **William G Davenport** has been made vice-president in charge of sales.

Hazard wire rope division of **American Chain & Cable Co** has named **Russell H Foss** sales manager for New York district, with headquarters at 230 Park Ave, New York, N. Y. . . . **Wickwire Spencer Steel Co** has made **M G Werme** chief development engineer and **Victor Chartner** chief mechanical engineer. General sales office of mechanical specialties division of Wickwire Spencer will be located at Clinton, Mass. **Gordon Lloyd** has been appointed superintendent of Clinton plant. District sales office will continue to be at 500 Fifth Ave, New York, N. Y. . . . **M K Saunier** represents **Progressive Welder Co** in Chicago area. **Wallace A Stanley** returns to headquarters office as special assistant to field sales manager . . . **W R Persons** has been transferred to factory and main office of **Lincoln Electric Co** at Cleveland to carry out a special postwar planning assignment and **J S Roscoe** has been appointed manager of Pittsburgh office.

Superior engine division of **National Supply Co** has made **Charles B Sherman** district manager of new sales office at Ames, Iowa . . . **American Locomotive Co** appoints **Alexis J Diakoff** as con-

As Modern As 312 B.C.



THIS huge pile of masonry is part of the Old Croton Aqueduct, delivering daily twenty-four million gallons of water to New York City. Old Croton is solid brickwork, concrete, and cast iron, 41 miles long, completed in 1848 after 11 years of work at a cost of $11,500,000.

Old Croton is only a hundred years old, but it might just as well be 2,256 years old, for it copies the principles and design of the even more famous Claudian Aqueduct of 312 B. C. whose ruins our boys see at Rome.

The modern way to provide cities with a permanent water supply is by means of steel pipe. Through one 24-inch steel pipe, for example--could be pumped as much water as this old aqueduct carries.*

Old Croton and the Claudian Aqueduct remind us that Steel, in its many versatile applications, has made America "modern" — also that Steel has a tremendous job still to do. Now dealing death and destruction to the enemies of civilization, Steel will have the task of helping restore world peace and prosperity. This basic metal, of which Youngstown is a leading manufacturer, will help make the post-war world a far better place in which to live.

**Figured according to Hazen - Williams "C" values.*

YOUNGSTOWN

THE YOUNGSTOWN SHEET AND TUBE COMPANY

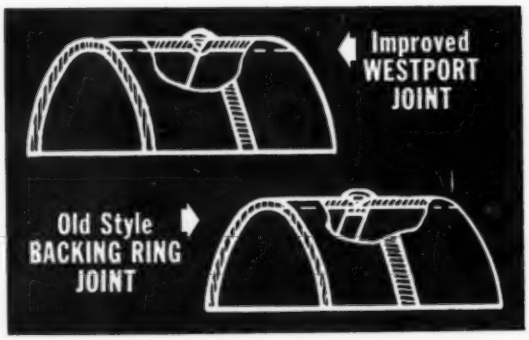
YOUNGSTOWN, OHIO

Manufacturers of

CARBON - ALLOY AND YOLOY STEELS

Pipe and Tubular Products - Sheets - Plates - Conduit - Bars - Electrolytic Tin Plate - Coke Tin Plate - Rods - Wire - Nails - Tie Plates and Spikes - Alloy and Yoloy Steels.

This Welded Joint



Eliminates Protrusions in pipes!

The Westport Patented Welded Joint provides a smooth pipe contour at the base of every weld.

There are no "icicles" . . . no protrusions!

This new method, especially suitable in the welding of heavy wall piping for high-pressure-temperature conditions, is proving satisfactory in lines operating at 1250 pounds per square inch and 925 degrees F. total temperature steam service.

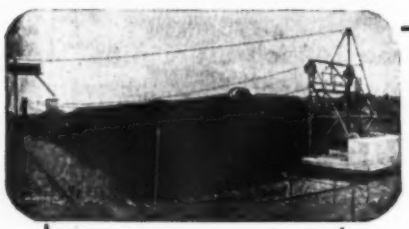
Mitchell's service includes this Westport method, which consists of the use of a joint in which the ends to be welded are formed and machined to provide a special U-shaped groove, joining the lips at the root of the weld by the oxyacetylene process and completing the joint by the usual electric arc procedure.

Important: With the Westport Joint, there's no sacrifice in the strength of the pipe due to removal of wall or Backing Ring . . . there are NO gaps between rings and inside of the pipe wall . . . and there's greater flexibility in alignment of pipe, valves and fittings!

WRITE WITHOUT DELAY FOR FULL DETAILS

W. K. MITCHELL & CO., Inc.
PHILADELPHIA 46, PENNA.

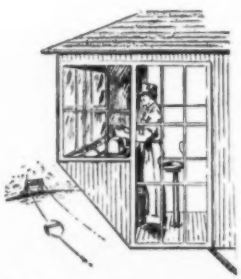
1899 — 1944



STORE COAL
with less labor!
—at lower cost!

Picture shows a Sauerman Scraper System with mobile tail tower handling a 40,000-ton stockpile on a semi-circular area 280 ft. in radius. Powered by an 80 hp. motor, the scraper system handles an average of 100 tons an hour, either storing or reclaiming.

SAUERMAN Scraper Systems are simple, economical, flexible, and will pile a maximum tonnage in any area, regardless of the size, shape or condition of the ground.



Operator in station overlooking storage area has "pushbutton" control of entire operation, including travel of tail tower seen in background of sketch.

One man operation, under clean, attractive conditions, assures low cost, thrifty handling of every ton of coal in and out of storage.

Sauerman equipment will build a perfect, homogeneous pile as high as desired. Avoids segregation and combustion hazards of air pockets.

Tell us about your own problem and our engineers will give you their idea of a solution. Also, we will send you an interesting booklet.

SAUERMAN BROS., Inc.
562 S. Clinton St. — **Chicago 7, Ill.**

sulting engineer of diesel engine department of Schenectady plant . . . **J O Ross Engrg Corp** announces that **Frank W Partsch** will be in charge of new branch office in Boston . . . **Frank Wilhelms** joins **Edwin L Wiegand Co** as assistant to president . . . **Weatherhead Co** announces that **H Church** has been promoted to vice-president in charge of sales, **George H Hufferd** to vice-president in charge of engineering and **Robert P Gibson** to vice-president in charge of automotive sales. **Morris H Wright** is new assistant to president of same company . . . **Frederick W Smith** joins Carrier Corp.

Wilkening Mfg Co announces appointment of **Thomas W Moss** as Detroit representative, succeeding **Warren K Lee**, who is now factory manager at Wilkening headquarters . . . **Square D Co** has made **Walter H Bodle** manager of new manufacturing plant and warehouse in Seattle . . . **Leslie J Woods** has been named manager of industrial radio division of **Philco Corp,** with headquarters in Detroit. **Martin F Shea** has been appointed assistant manager of division.

Allied Radio Corp has been named distributor for **Littelfuse, Inc** . . . New distributor for **Plibrico Jointless Firebrick Co** is the **Muesing-Merrick Coal Co,** 401 S State St, Indianapolis, succeeding the late **Charles W. Pieters** . . . **C G Kahant Co** has been made New York district representative for **Southern States Equipment Corp.**

Gordon Lefebvre, president of **Cooper-Bessemer Corp,** has been elected to executive committee of **Machinery & Allied Products Institute.** Election was to fill

one of five vacancies on committee while ten other members succeed themselves. Executive committee is made up of executives from country's leading machinery builders.

Frostrode Products has moved to a larger plant at 19929 Exeter, Detroit . . . New York factory branch of **General Controls** occupies new quarters at 101 Park Ave. Cleveland branch also moved to new quarters at 3224 Euclid Ave, with **L E Wetzell** in charge . . . **U S Machine Corp** announces the leasing of warehouse facilities in New York City, outright purchase of Chicago branch property and expansion of Lebanon plants . . . New department has been set up to provide special postwar engineering, combustion

Now . . .

MORE ACCURATE READINGS OF BOILER WATER LEVELS

"Positive as the Law of Gravity"

The Yarway Remote Liquid Level Indicator offers you this on a brightly-lighted scale right on your instrument panel or at any other convenient location. No more guessing at hard-to-see gages. No more risk of serious damage to equipment due to inaccurate water level readings. *Now double-check your overhead gage readings with this Yarway Eye-level Instrument.*

Its accuracy and dependability are "positive as the law of gravity" for this instrument literally "weighs" the difference between a constant column of water and the varying level in boiler drum and indicates the difference by pointer movement over a calibrated scale.

Indications are instant. The luminous pointer follows the water level constantly—is always visible, even in complete darkness. The indicating mechanism is never under pressure—is frictionless—is perfectly balanced on jewelled bearings. *There are no stuffing boxes.* Indicating and actuating mechanisms are completely separated, but operate simultaneously through a powerful, permanent magnet transmission.

Accelerated endurance tests in the Yarway Steam Laboratory have duplicated 50 years of normal boiler service without need for repair, replacement of a single part or recalibration.

Easily installed on new or existing boilers or other equipment requiring liquid level indication.

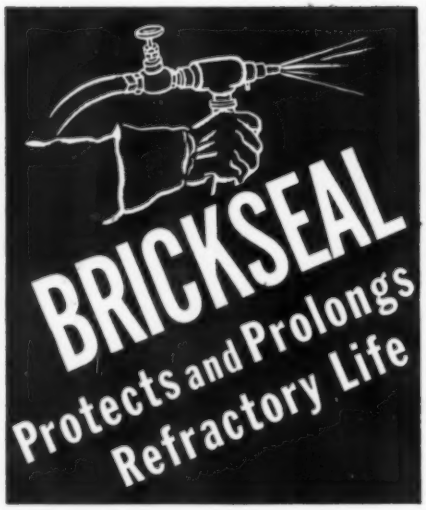
Suitable for pressures up to 1500 lb. Hundreds have been purchased and repeat orders indicate enthusiastic user satisfaction. Write for Bulletin WG-1820.

YARNALL-WARING CO. 100 Mermaid Ave., Phila. 18, Pa.

Above: The Yarway Remote Liquid Level Indicator for mounting on wall or building column.

Below: Two Yarway Liquid Level Indicators mounted on instrument panel of prominent high pressure New Jersey Utility.

YARWAY REMOTE LIQUID LEVEL INDICATOR



Applied like paint, prevents cracking and spalling

Now, more than ever, anything which prevents interruption of steam production is of vital importance. Brickseal refractory coating prolongs the life of new or old brickwork by preventing disintegration due to cracking, spalling and slagging.

Brickseal consists of high-fusion clays and metals combined in oil. Furnace heat drives off the oils and vitrifies the clays and metals, permanently binding the bricks with a highly-glazed, vitreous, monolithic coating, impervious to gases, carbon and air infiltration. The highly reflective surface keeps heat inside and increases boiler efficiency.

At operating temperature Brickseal becomes semi-plastic so that it expands and contracts with the wall, and therefore cannot crack, peel or blister due to sudden temperature variations. This feature also enables Brickseal to bind loose brickwork and old cracks. Slag and clinkers can be removed without damage to lining. Brickseal is applied easily with brush or spray gun, and the boiler may be fired at once. At very little cost, Brickseal will assure longer, uninterrupted production. Write for sample.

BRICKSEAL
REFRACTORY CO.
1029 CLINTON ST., HOBOKEN, N. J.

and research service to customers of **Koppers coal division** of Eastern Gas and Fuel Associates . . . **Mitchell Mfg Co** announces a consolidation with **Tru-Ad Co.** Los Angeles factory operates under name of **Tru-Ad division** of Mitchell . . . **MetalFusion Corp of America** has become a subsidiary of Cook Electric Co.

William Goodman, author of *Air Conditioning Analysis,* consulting engineer for **Trane Co** and designer of air-conditioning equipment, has been appointed research professor of refrigeration and air conditioning at **Illinois Institute of Technology.** Conducting both undergraduate and graduate courses in air conditioning at Illinois Tech, he will also carry out research studies and experimental investigations in this field . . . Board of Regents of University of State of New York has granted permission to change name of **Rochester Athenaeum & Mechanics Institute** to **Rochester Institute of Technology.** Mechanics Institute was founded in 1885 by Capt Henry Lomb and a group of Rochester industrialists and merged with Athenaeum in 1891.

Clement L Kline, mechanical engineer, located at 1110 S Main St, New Castle, Ind., announces a specialized piping service, including plans, specifications and supervision for construction of piping systems handling steam, air, water, gas and oil . . . **R R Robertson** retires because of illness as chief electrical engineer and deputy general manager of **Department of Water and Power,** Los Angeles . . . **Alabama Power Co** establishes a department of public relations with **Lewis M Smith** as director.

American Society for Testing Materials announces 1944-45 officers as follows: pres, P H Bates; vice-pres, Arthur W Carpenter; executive committee, W C Hanna, L B Jones, J T MacKenzie, J G Morrow, Sam Tour.

POWER Shortage— What to Do About It

Because paper is critically short, POWER's circulation is unavoidably frozen at present levels. That's why over 2000 engineers who want to subscribe today cannot be served—are on the waiting list. Established subscribers coming up for renewal don't have to wait if they get their orders in promptly, but some have let their subscriptions lapse and have thereby lost their priority. When that happens, it takes from one to three months to get back on the lists—and generally there is no way to buy, borrow, beg or steal the numbers missed.

To insure unbroken service and to protect yourself from inconvenience, the editors urge you to renew promptly on receipt of first notice. Sorry—it's war!

Clamp – Splice – Tie – Repair – Mend – Reinforce *with*

PUNCH-LOK *Streamlined* **BANDING METHOD**

In all types of industry—production, maintenance or service—Punch-Lok Banding Method is at work . . . connecting hose, stopping leaks in steam or water lines, splicing electric cable, reinforcing and mending splits in cross-arms, poles and ladder rails, tieing rigid conduit or flexible cable to pipe lines or girders, seizing ends of wire or manila rope to prevent fraying . . . in short, wherever a banding method can be used to connect, mend, splice or reinforce. Open end bands available for use when ends of work are obstructed. There are places in your industry where Punch-Lok Clamps would save you time and money.

CLAMPS . . . Made of flat, high tensile galvanized steel or of Everdur, which is a corrosion-resistant copper base alloy. All clamps are double wrapped. Available from ¾" to 48" I.D. Any larger size clamp can be pulled down to fit any smaller diameter.

LOKING TOOL . . . Sturdily constructed to assure long life. Locks all size clamps with a sufficient tensional pull.

GROOVED FITTINGS . . . For hose lines—air, water, steam or any other fluids. Permits application of high pressure clamping without damage to hose.

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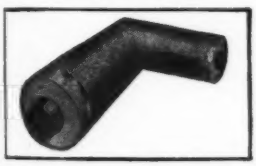
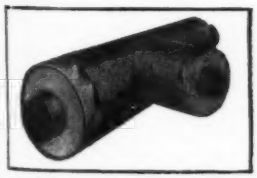
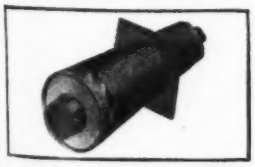


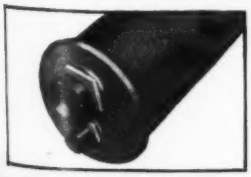
Prefabricated elbow unit



Prefabricated T-branch unit



Prefabricated anchor unit



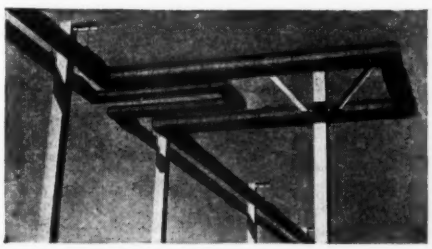
Prefabricated gland seal

FACTORY PREFABRICATION SAVES TIME AND MONEY ON THE JOB

Every contractor knows the loss of time, the hazards and the cost of sundry materials needed for insulating, waterproofing, wrapping and wiring of overhead pipe lines, when this operation has to be done on scaffolding. He also knows the amount of excavation and skilled labor required to apply insulation and protection on underground lines. The Ric-wiL Unit Method of installation eliminates most of this field work and makes possible phenomenal speed on the job. Prefabricated 21-foot sections are delivered to job site—complete with pipe, insulation, couplings and accessories—ready for hoisting onto trusses or lowering into narrow trenches. Often a number of units are welded and coupled on the ground before installation, minimizing overhead and trench work under difficult conditions. On one job, 1500 feet of Ric-wiL Conduit were installed in place on channel steel uprights, and pipe welded, ready for couplers and insulation between units—*in only two working days* . . . Ric-wiL Insulated Pipe Units are available in single or multiple pipe systems, for piping steam, hot water, oil or viscous fluids where flow temperature must be maintained.

PREFABRICATED EXPANSION LOOPS

Completely assembled expansion units are provided as required, fitted with couplers, ready for quick installation. Adaptable to underground, surface, and overhead systems.

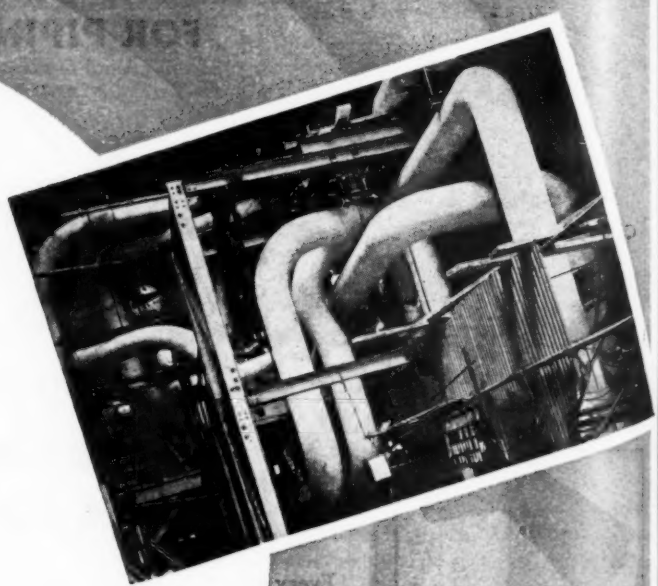


Typical installation showing double overhead expansion loob jor steam and return line.

RIC-WIL INSULATED PIPE CONDUIT SYSTEMS
THE RIC-WIL COMPANY · CLEVELAND, OHIO
AGENTS IN PRINCIPAL CITIES

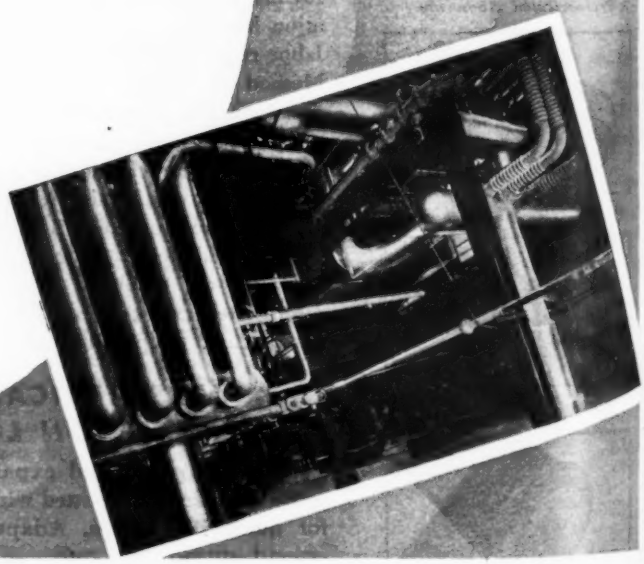
KELLOGG *Prefabricated* PIPING...

... Saves Time... Overcomes many complicated piping problems



Prefabricated assemblies for complicated piping systems designed with the aid of the KELLOGG Scientific Method of Determining Moments and Forces Electrically solve the most complex and highly specialized temperature and pressure requirements of public utility, process and marine power plants.

Consulting engineers and operators of central stations, industrial and marine power plants find that placing the entire responsibility of difficult piping installations with The M. W. Kellogg Company offers a satisfactory solution to their problems.



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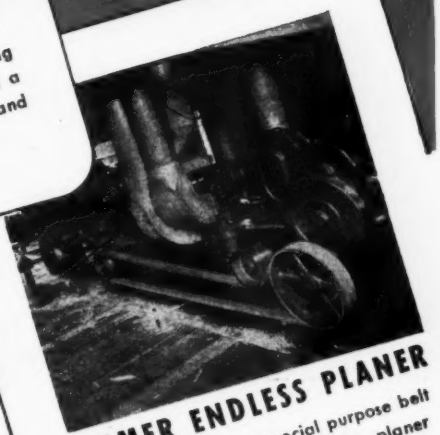
Gilmer makes complete line of V-Belts, Endless or Non-endless Flat Belts, and a full range of highly specialized belts for use wherever standard belts are unsuited. For further information about the various Gilmer Belts and their plant applications, write for a FREE copy of the Gilmer Belt Catalogue.

GILMER V-BELTS: Space-saving, silent, shock-absorbing belts, built to lock in the grooves with a non-slip grip. Made in standard and special sizes.

GILMER KABLE KORD BELTS: Rubber fabric and tough continuous cord construction give you a contactor and power belt in one. Exceptional grip and strength combine in these flat belts with low stretch, small slippage and extra tensile strength.



GILMER ENDLESS PLANER BELTS: A typical special purpose belt of endless cord construction for planer and gang-saw drives.

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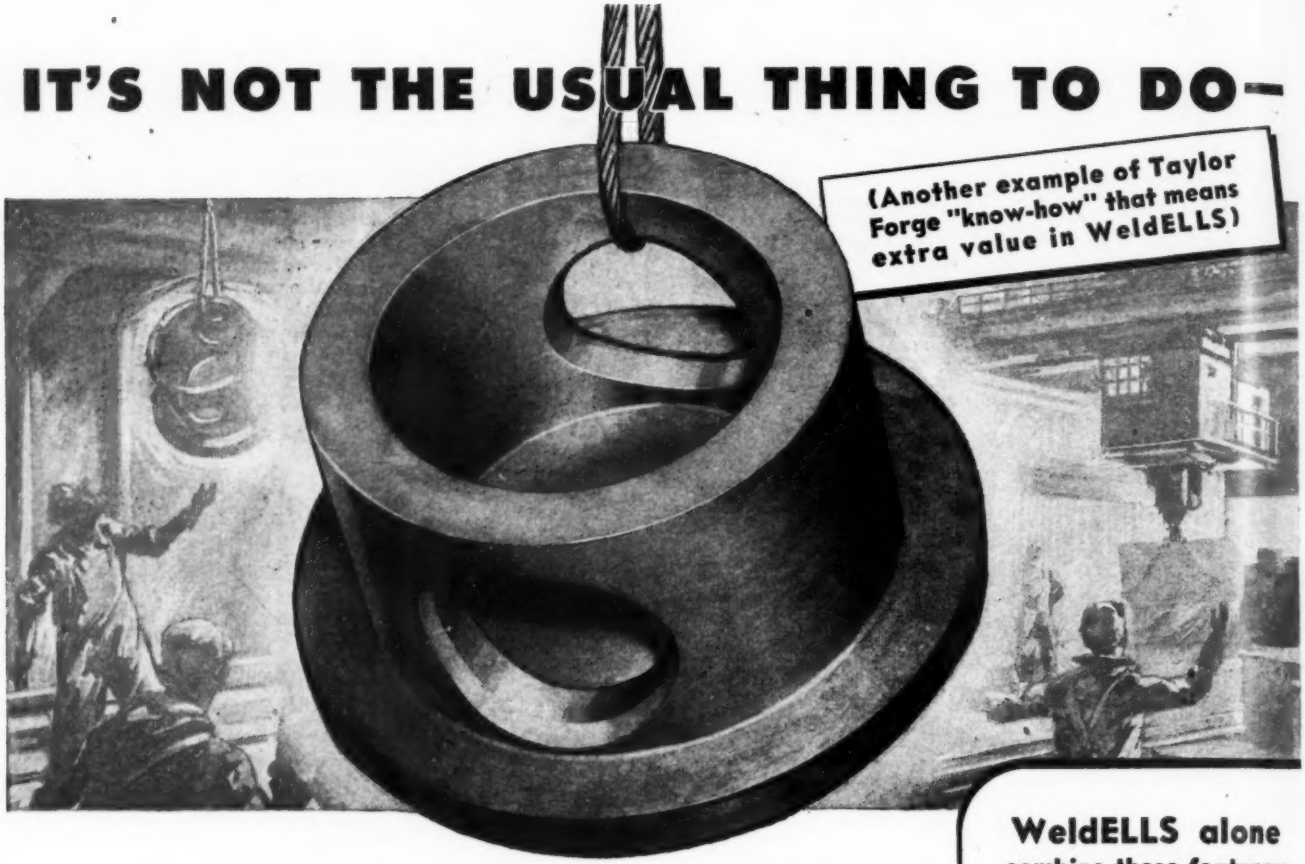
IT'S NOT THE USUAL THING TO DO—



(Another example of Taylor Forge "know-how" that means extra value in WeldELLS)

*_Taylor Forge was the first, and is still the foremost, manufacturer of forged and rolled steel welding necks, nozzles and channel sections. An unusual and interesting forging of this kind is the blind channel section with side openings illustrated above._

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Yes, over the years we have been called upon to perform so many special forging operations that the unusual has, in a sense, become the usual here at Taylor Forge. And there is no better example of this than the *special* operations which contribute extra value to our *regular* line of WeldELLS and other Taylor Forge welding fittings.

Special steps are necessary to attain the uniform strength achieved in WeldELLS through proper distribution of extra metal where stresses are greatest. A special truing operation accounts for the extreme dimensional accuracy for which WeldELLS are so favorably known. Tangents, too, require a special process, and we could cite many more extra steps that go into the production of WeldELLS.

In fact, you will find that Taylor Forge "know-how" acquired in the tough school of experience is reflected in every one of the features of WeldELLS listed opposite. Check them over and we believe you will agree that . . .

WeldELLS alone combine these features:

- **Seamless** — greater strength and uniformity.
- **Tangents**—keep weld away from zone of highest stress—simplify lining up.
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- **Wall thickness never less than specification minimum**—assures full strength and long life.
- **Machine tool beveled ends**—provides best welding surface and accurate bevel and land.
- **The most complete line of Welding Fittings and Forged Steel Flanges in the World** — insures complete service and undivided responsibility.

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. . . *perfect balance prevents shaft distortion . . . saves bearings*

* Pump and motor are a single simple, balanced unit in the Worthington MONOBLOC *centrifugal* pump — so operation is quiet, service is efficient, life is longer.

Alignment is perfect and permanent . . . no separate distance piece is required between pump and motor. And a base plate is unnecessary even on the larger sizes—saving floor space and installation cost.

Worthington is the first manufacturer to build a complete line of electric-driven *centrifugal* pumps of the Monobloc design that are truly balanced units — planned and mated *on the drawing board.*

The DE type for heavier general service includes pumps at capacities to 1600 G.P.M. and heads to 300 ft. — mated to the precise H. P. and R. P. M. for most efficient operation.

For details write for bulletin . . . using the coupon at the lower right.

180 pages of vital information in this easy-to-use catalog

It will pay you to have at your finger tips all the technical information about centrifugal, power, rotary and steam pumps, air compressors and liquid meters contained in this conveniently tabbed catalog. Check coupon.

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Standard Products Division
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Please send me complete Standard Industrial Products Catalog, including information on Monobloc *Centrifugal* Pumps.

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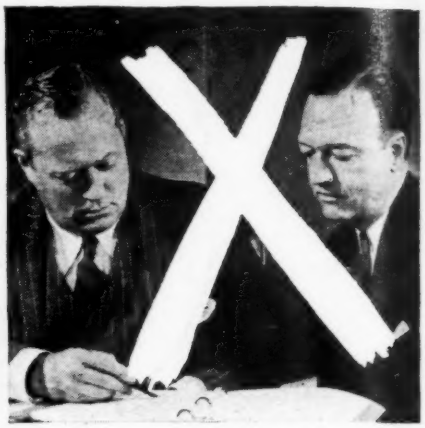
If you use Prefabricated Piping, Pressure Vessels and Heat Exchangers

ALCO "Triple Service" can save you Time and Money



WHEN you buy prefabricated piping, pressure vessels, and heat exchangers from ALCO, you save time and money. Here's why:

1. PURCHASING WILL COST YOU LESS

If you buy these products from separate sources, your purchasing department will be compelled to deal with at least three companies; negotiations will be needlessly complicated, consume more time, cost you more money. But by letting ALCO supply your requirements for all of these products, you simplify purchasing, save time and expense.

2. ENGINEERING WILL COST YOU LESS

When you purchase prefabricated piping, pressure vessels, and heat exchangers from three or more different sources, your engineers are compelled to deal with each of the various engineering departments of all these suppliers. That means more time and money loss to your organization. This waste, too, can be saved when you deal with ALCO on all these counts.

3. INSPECTION WILL COST YOU LESS

If you buy prefabricated piping from one source, and pressure vessels and heat exchangers from others, you must send three inspectors to the three plants fabricating your equipment. ALCO "triple service" means all inspection can be handled by one inspector at our Dunkirk plant.

4. ACCOUNTING WILL COST YOU LESS

Finally, your accounting department has three separate accounts to handle—instead of one—if you deal with three suppliers of prefabricated piping, pressure vessels and heat exchangers, respectively; instead of leaving it all to ALCO.

. . .

ALCO's reputation for competence in designing, fabricating and delivering on time is beyond question. To rely on ALCO for prefabricated piping *and* pressure vessels *and* heat exchangers is good business for your company and will be thoroughly justified by *results*. We welcome the opportunity of demonstrating the advantages you gain by ALCO "triple service."

American Locomotive

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Heat Exchangers • Pressure Vessels • Prefabricated Piping

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The additional cost of power plant modernization to burn Fairmont low fusion coal is usually amortized the first year through savings in fuel cost. Thereafter, for the life of the plant, handsome dividends will be earned on the investment.

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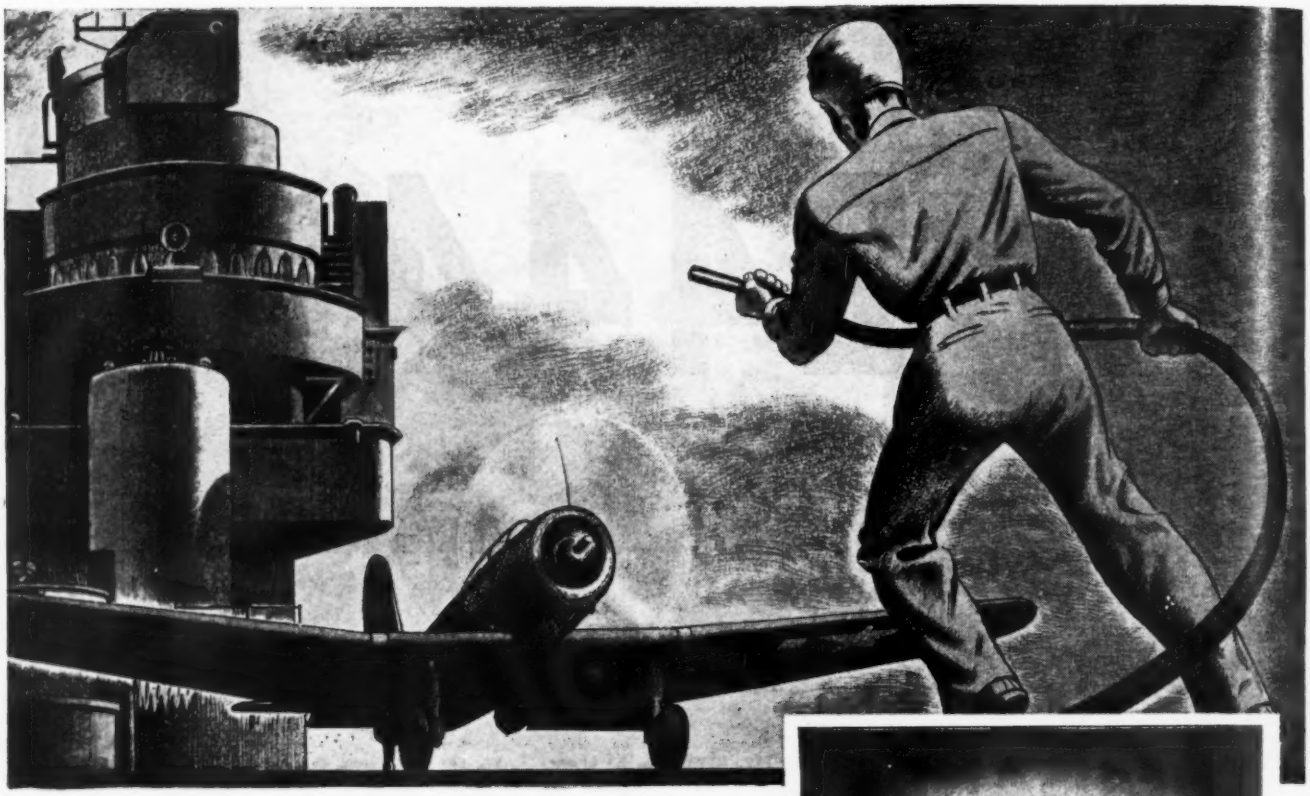


CHECKREIN FOR LIQUID HORSEPOWER

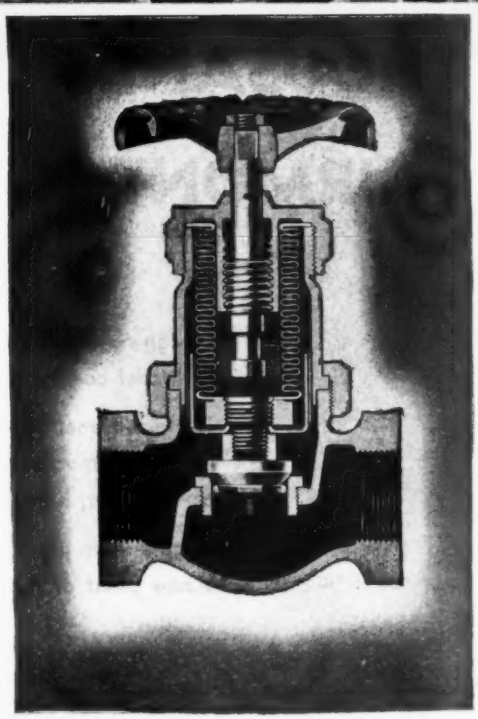
THE STORAGE AND HANDLING of thousands of gallons of high-octane gasoline was one of many difficult problems confronting the engineers who designed our fleet of aircraft carriers. The basic fundamentals of modern hull design immediately ruled out construction where there was even the possibility of leakage . . . especially minute, hidden leaks, such as can develop through stem assemblies on conventional valves.

Leakage at this point was prevented by the use of Sylphon Packless Valves, which can't possibly leak, because there is *no packing* for liquids or gases to seep through.

Instead of packing—a sturdy, dual-ply bellows of special analysis metal rides with the disc assembly . . . positively sealing against leakage.

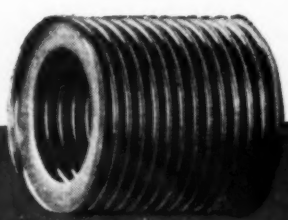
Sylphon Packless Valves in sizes ½" to 2" are suitable for pressures up to 150 lbs. and can be supplied with either screwed or flanged connections. Sizes 2½" to 6" are suitable for pressures up to 80 lbs. and have flanged connections.

Write for Bulletin VS-20.



Sylphon Packless Valves are handling hazardous liquids such as aviation gasoline, and are ideal for process piping where critical pressure or vacuum lines are employed.

ARMY E NAVY



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TEMPERATURE CONTROLS . . . BELLOWS . . . BELLOWS ASSEMBLIES

THE FULTON SYLPHON CO., KNOXVILLE 4, TENNESSEE

Canadian Representatives, Darling Brothers, Montreal

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— one of a number of subjects thoroughly covered in this new 32-page Elliott bulletin on tube cleaning methods and equipment.

Y-231

THE NEW TUBE CLEANING HANDBOOK BY

ELLIOTT

may give you a new slant on a tough tube cleaning problem. May save you hours of productive time. May prevent damage to costly equipment. The coupon brings your copy.

ELLIOTT COMPANY
Tube Cleaner Department, Springfield, Ohio

Send me the new Bulletin Y-18 on Tube Cleaners.

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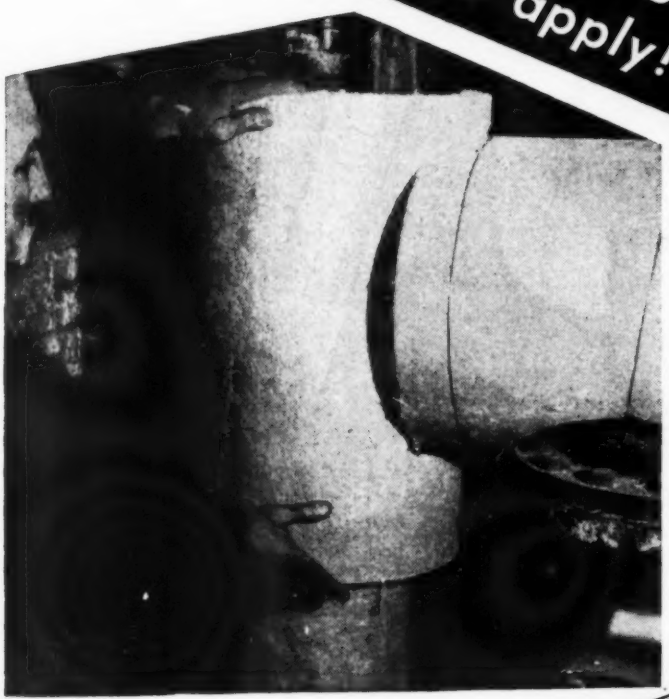
GETTING "HOT UNDER THE COLLAR"?

SIMPLY APPLY UNIBESTOS

it's simple to apply!



It's easy to cover flanges and fittings with Unibestos, the sectional insulation. Unibestos saws or cuts clean and sharp with ordinary tools—no mess. Here's how it's done: bring adjacent pipe covering up to proper level by use of a collar of a standard section of Unibestos and then simply span both flanges with a single piece of sectional Unibestos properly cut to fit. That's all there is to it!... and you have a smooth, neat, efficient and readily-removable installation.

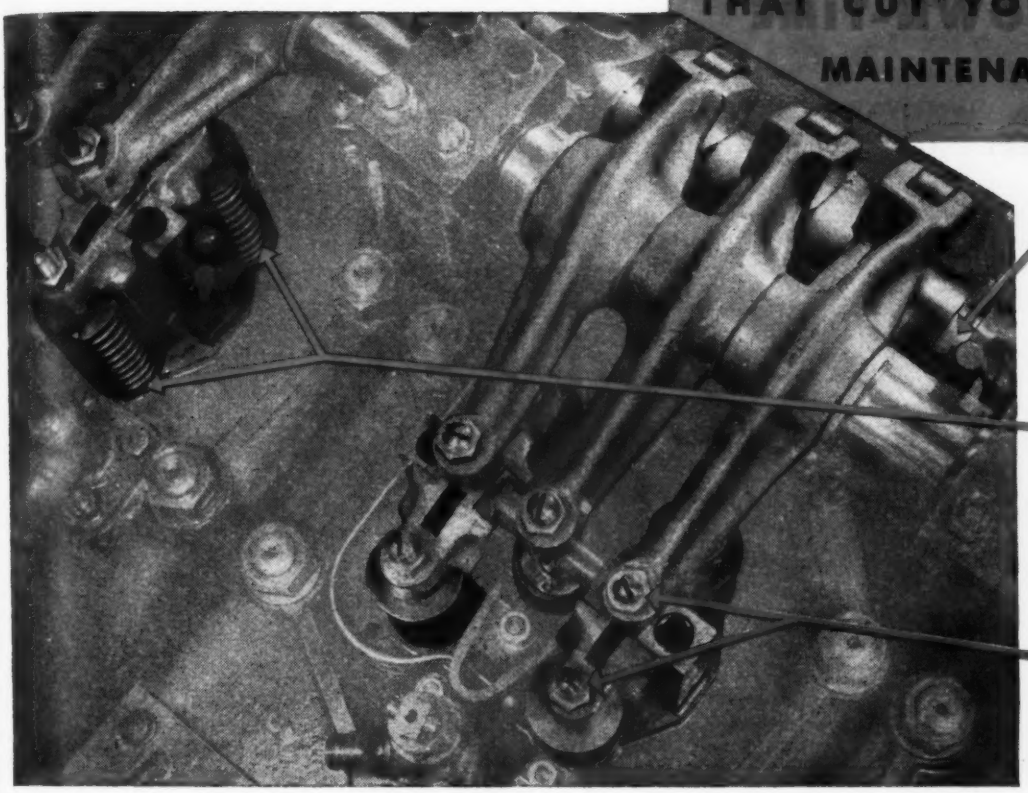
UNION ASBESTOS
MEANS PROGRESS IN INSULATION
AND RUBBER CO.

ARMY E NAVY

PLANTS: 1821 S. 54th Ave., CICERO, ILL. • PATERSON, N. J. • BLUE ISLAND, ILL.
OFFICES: CHICAGO • CICERO, ILL. • NEW YORK • SAN FRANCISCO • PATERSON, N. J.

COPYRIGHT 1944
UNION ASBESTOS AND RUBBER CO.

THREE HENDY FEATURES THAT CUT YOUR DIESEL MAINTENANCE COSTS



1. OVERHEAD CAMSHAFT

Reduces maintenance by eliminating parts and complicated linkage.

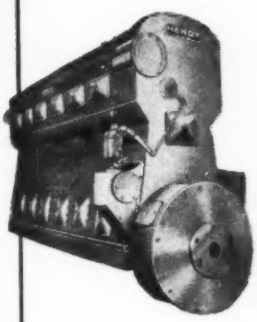
2. DIRECT-ACTUATED DUAL VALVES

Reduce maintenance by prolonging valve-stem and guide life.

3. HYDRAULIC TAPPETS

Reduce maintenance by eliminating manual tappet adjustment.

HENDY SERIES 50 DIESELS



Hendy Diesels—6 or 8 cylinders, from 350 to 675 hp—are designed for marine and industrial use—or with Hendy generators, as complete electric generating plants.

Write today for complete data, ask for the new Hendy Series 50 Diesel Engine Catalog.

These three features of the Hendy Series 50 Diesel contribute directly to the lower maintenance costs a successful Diesel operator expects and must have.

The overhead camshaft eliminates the linkage of push-rods and valve-lifters for each cylinder—cutting maintenance by reducing the number of wear points. The valve mechanism, pressure-lubricated through hollow rocker-arm shafts, lasts longer because positive-acting cross heads, or dividers, assure even pressure on dual intake and exhaust valves and eliminate side thrust. Hydraulic tappets automatically maintain correct tappet clearance at all times, making manual adjustment unnecessary.

Any one of these features in a Diesel is an aid to lower maintenance costs. But the Hendy Diesel has all three. Even more, the Hendy Diesel has many other advantages never before combined in a single engine. Investigate the advantages of this modern Diesel today.

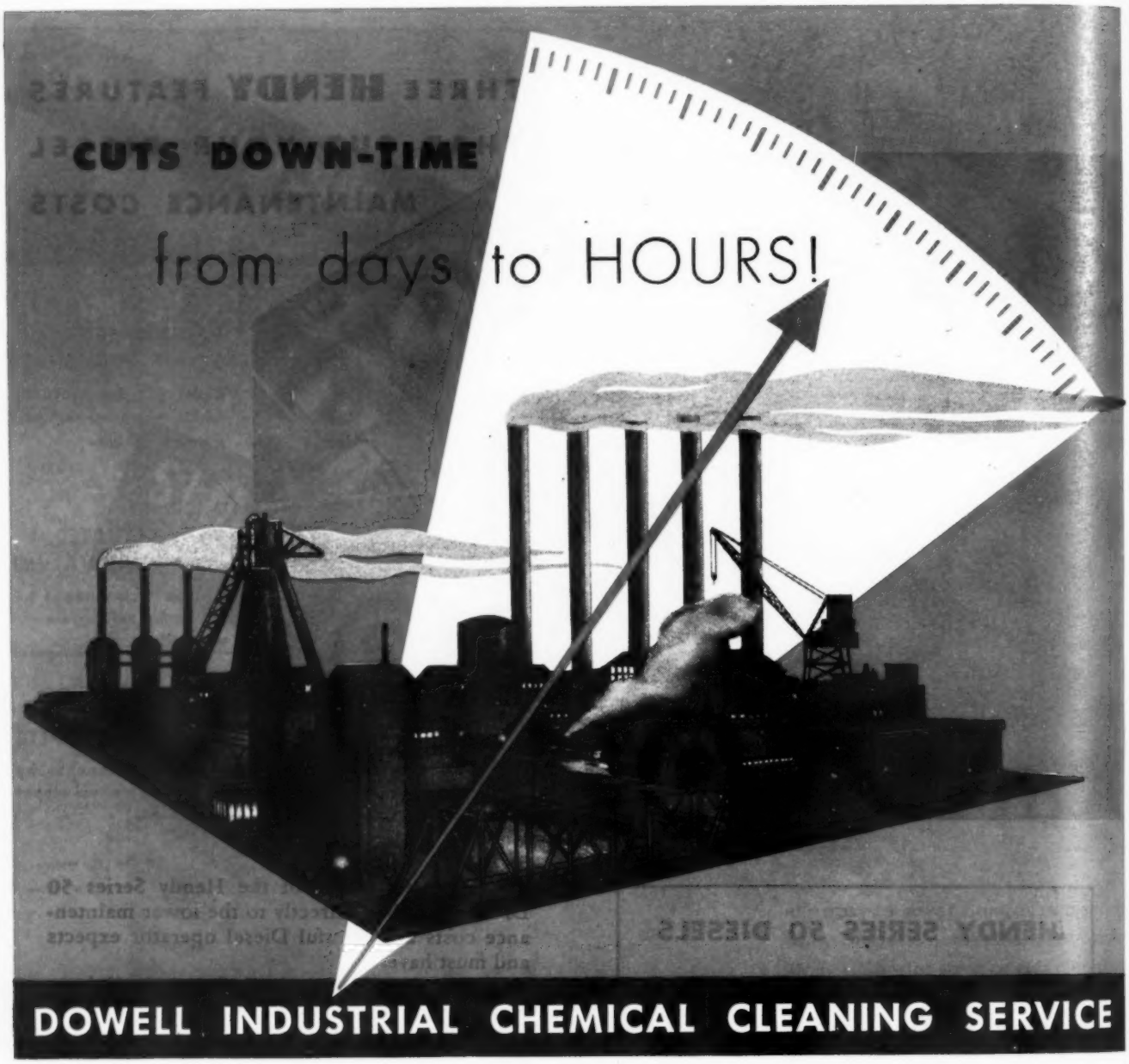
JOSHUA HENDY IRON WORKS

ESTABLISHED 1856

SUNNYVALE, CALIFORNIA

45-V

Branch Offices: BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND • DETROIT • NEW YORK • PHILADELPHIA • PITTSBURGH • SAN FRANCISCO • ST. LOUIS • WASHINGTON • LOS ANGELES



Water- and steam-deposited scale and sludge, thieves of vital power production, now are removed in *hours* of down-time . . . through Dowell Chemical Cleaning.

This notably faster re-energizing service not only saves valuable time and expense, but does so with complete safety to heat exchange equipment. There is no dismantling. After careful analysis, specially adapted solvents are applied by trained engineers in charge of mobile pumps and apparatus.

Dowell Chemical Cleaning Service is readily available at centers of industry in many states. It is a modern chemical development—made possible by close Dowell cooperation with its parent organization, The Dow Chemical Company.

DOWELL INCORPORATED

Tulsa 3, Oklahoma

Subsidiary of The Dow Chemical Company

Contact Dowell's Nearest Office for Complete Information

New York • Philadelphia • Cleveland • Chicago
St. Louis • Kansas City • Houston • Long Beach
Salem, Ill. • Wichita, Kan. • Casper, Wyo.
Mt. Pleasant, Mich.

NORDBERG

The Largest Builder of Large Diesels in America

IS BUILDING

HEAVY DUTY, TWO-CYCLE

DIESEL ENGINES

FOR THE

U. S. MARITIME COMMISSION

AND THE

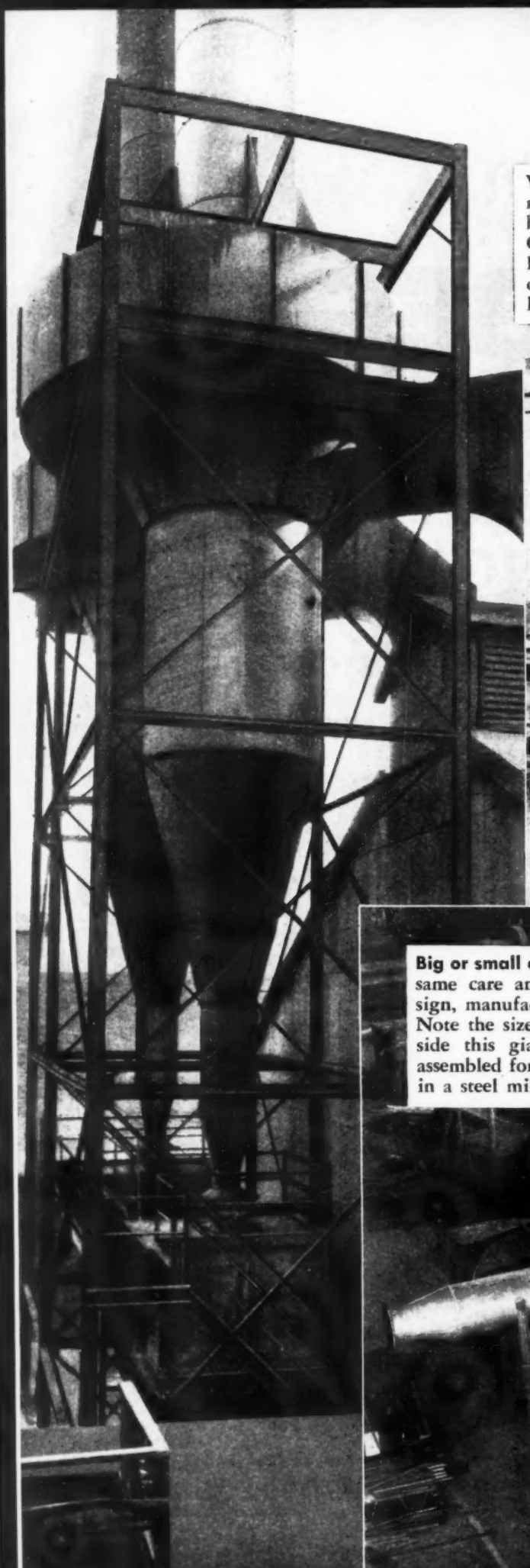
U. S. NAVY

THE FOLLOWING SIZES ARE NOW UNDER CONSTRUCTION:

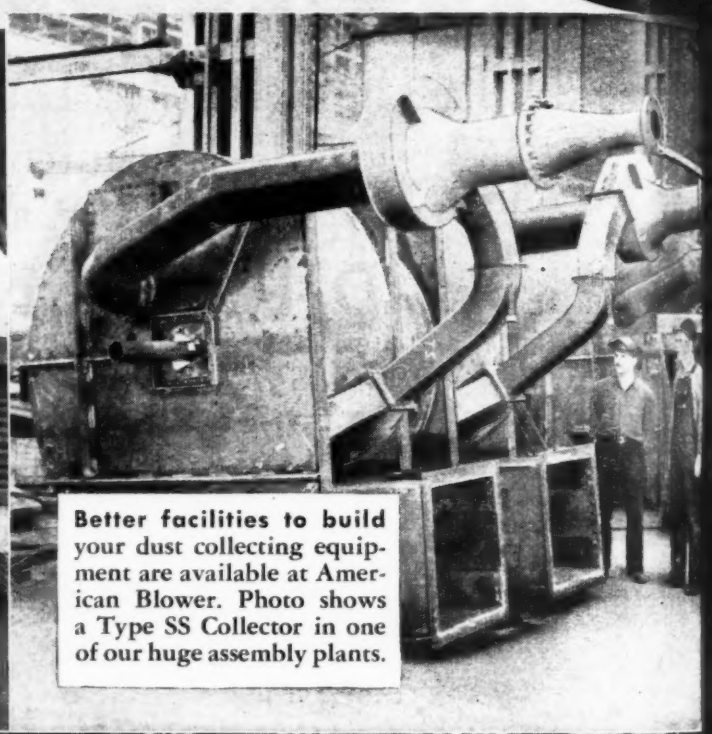
1250 H. P.
1400 H. P.
1700 H. P.
2075 H. P.
3158 H. P.
6000 H. P.

NORDBERG MFG. CO.

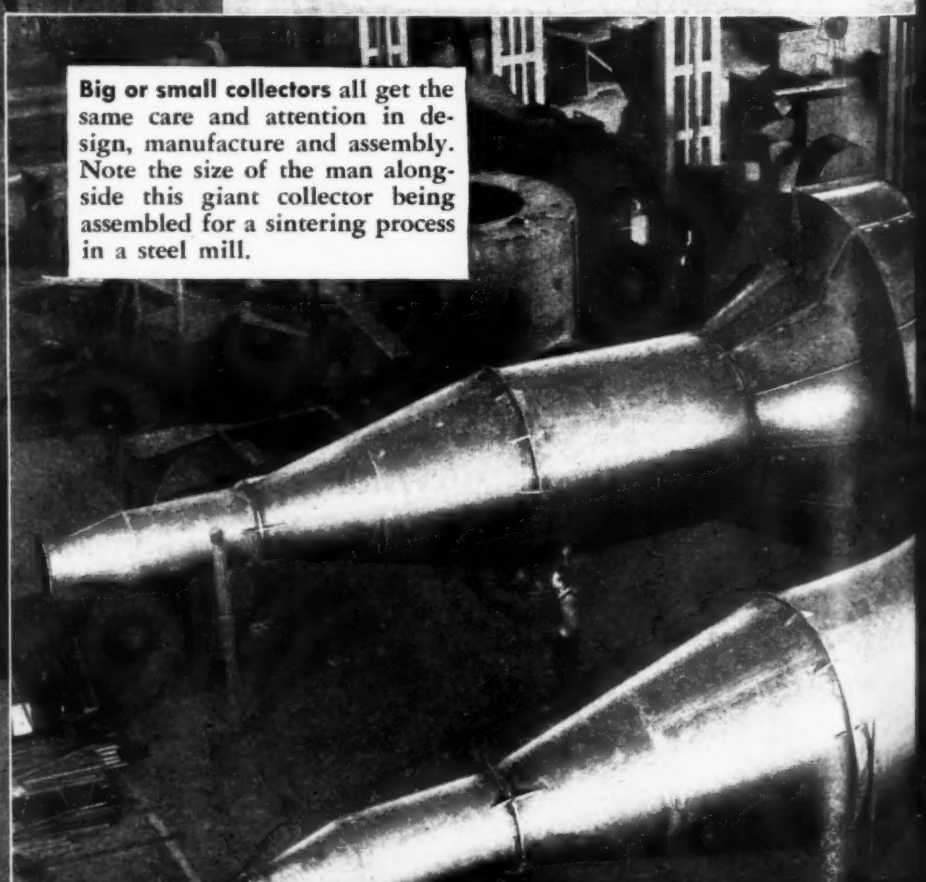
MILWAUKEE, WISCONSIN



Years of experience in minimizing the dust nuisance are behind American Blower Dust Collectors. This Type D Collector was installed a number of years ago in a nationally known cement plant.



Better facilities to build your dust collecting equipment are available at American Blower. Photo shows a Type SS Collector in one of our huge assembly plants.



Big or small collectors all get the same care and attention in design, manufacture and assembly. Note the size of the man alongside this giant collector being assembled for a sintering process in a steel mill.

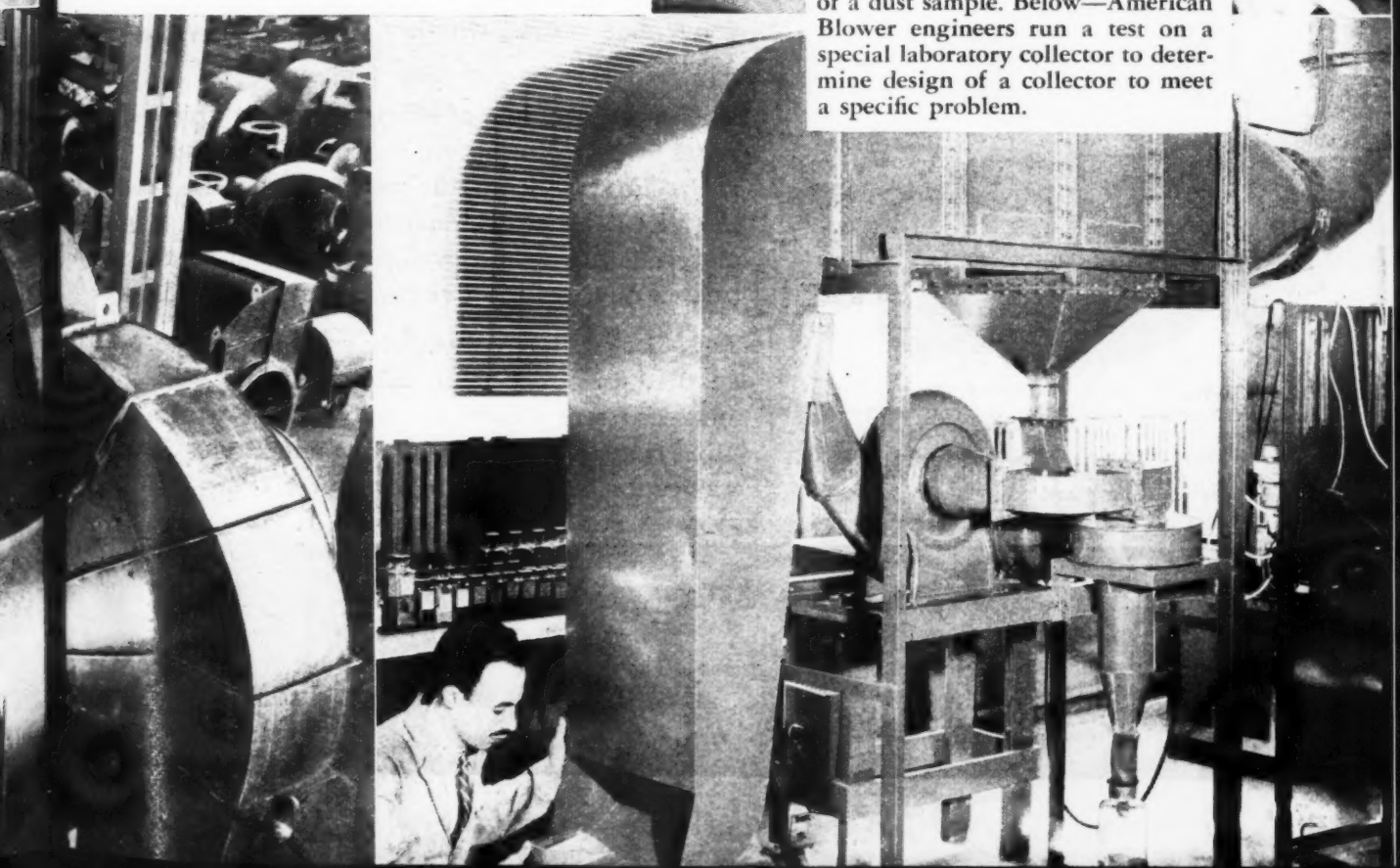
American Blower
DUST COLLECTORS

n dust collectors, this fact stands out. In the st 20 years, tests on more than 4100 dis-inctly different materials have been carried ut in the American Blower Testing Labora-ories. These tests include microscopic in-estigations, screen analyses, and collector erformance. This unprecedented back-round of experience insures your satisfaction ith American Blower Dust Collectors.

AMERICAN BLOWER

AMERICAN BLOWER CORPORATION, DETROIT, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONT.
Division of American Radiator & Standard Sanitary corporation

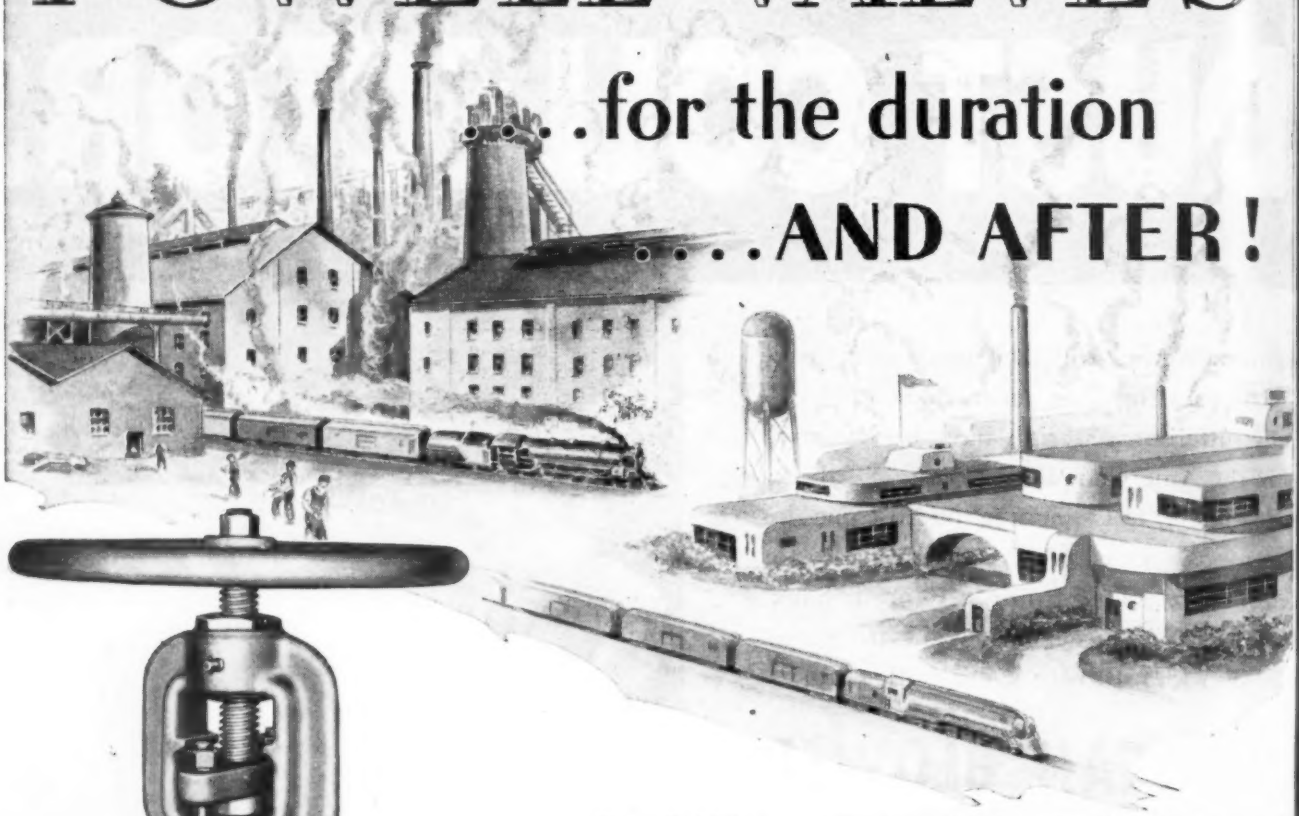
Put your problem in skilled hands. Above—a microscopic examination of a dust sample. Below—American Blower engineers run a test on a special laboratory collector to determine design of a collector to meet a specific problem.



POWELL VALVES

. . . for the duration

. . . AND AFTER!



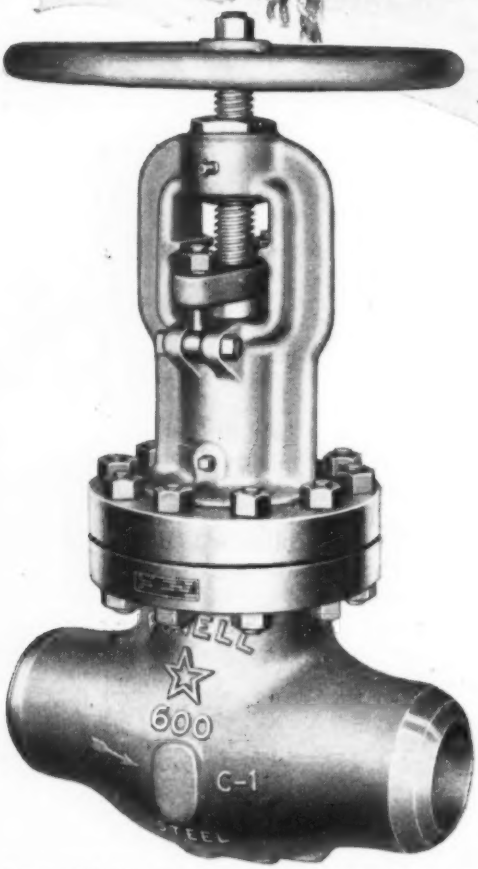


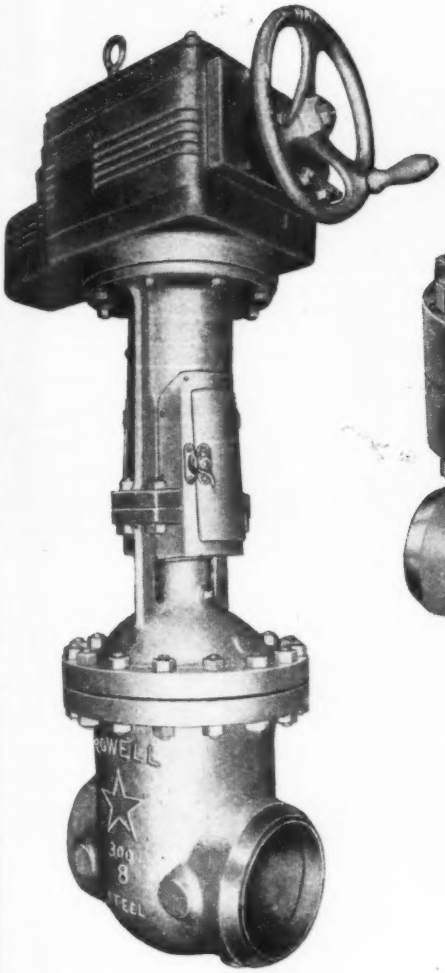
Fig. 6031-W. E.—Class 600-pound, Cast Alloy Steel, Welding End Globe Valve. Has outside screw rising stem, bolted flanged yoke, renewable semi-cone disc and regrindable, renewable seat ring. Sizes, 5" and larger are furnished with anti-friction bearing yoke and spur gears.

Powell Valves, now functioning flawlessly in every branch of War Industry, are good not only "for the duration" but for the durations of the coming cycles of peacetime production. Resultantly, Powell Valve buyers need face no scrapped installations when re-conversion comes, whether it come by degrees or all at once.

The basic principle of efficient flow control is, at all times, the *right valve,* in the *right spot,* for the *right job.* It is on this principle that the complete POWELL Line of industrial valves of all types and materials has been developed through nearly a century of successful valve manufacture.

The Cast Steel Valves shown here are especially adapted for power plant service. The POWELL Line includes Steel Valves of all types for working pressures from 150 to 2500 pounds and Boiler Feed Line Valves for corresponding pressures.

POWELL



8", Class 300-pound, Cast Alloy Steel, Welding End Gate Valve. An Electric Motor operator is mounted on top for quick, positive opening and closing.

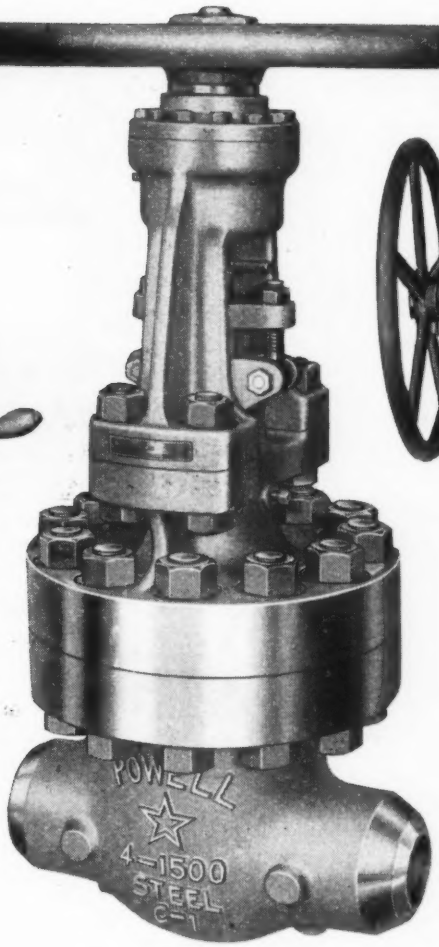
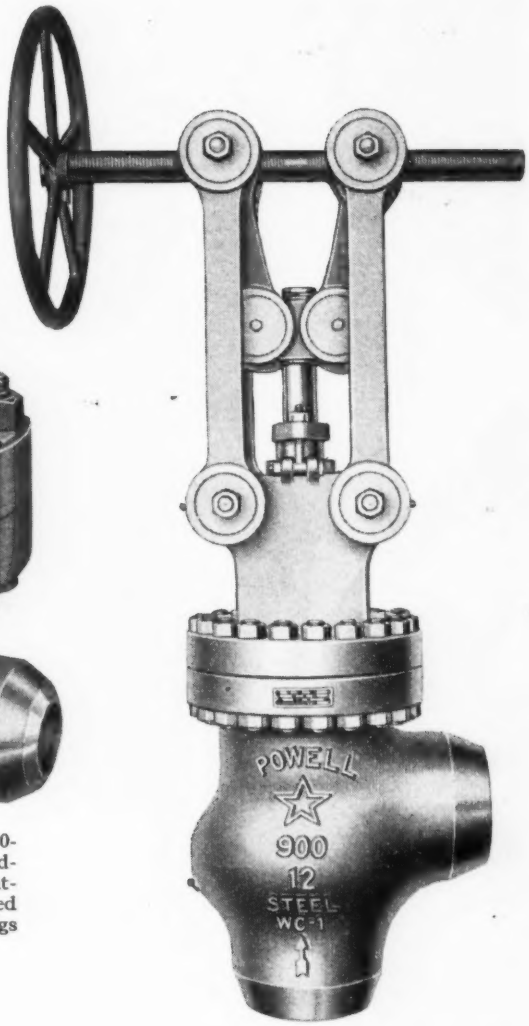
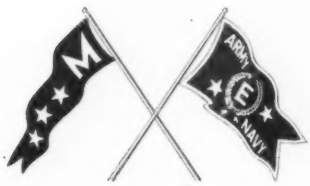


Fig. 1303-W. E.—Class 1500-pound, Cast Alloy Steel, Welding End Gate Valve. Has outside screw rising stem, bolted flanged yoke, renewable rings and taper wedge solid disc.



12", Class 900-pound Cast Alloy Non-Return Angle Valve, with welding ends. Toggle operated. Powell Non-Return Globe and Angle Valves are scientifically designed and engineered, with streamlined bodies that provide maximum flow area with minimum pressure drop. They can be supplied in various sizes and for all pressure classes from 300-pounds to 2500-pounds, inclusive.



The Wm. Powell Company

Dependable Valves Since 1846

Cincinnati 22, Ohio

VALVES

OPERATES ON "Continuous Balance" PRINCIPLE

THE Brown "Continuous Balance" Operating Principle differs basically from the usual self-balancing Potentiometer Systems in its balancing operation.

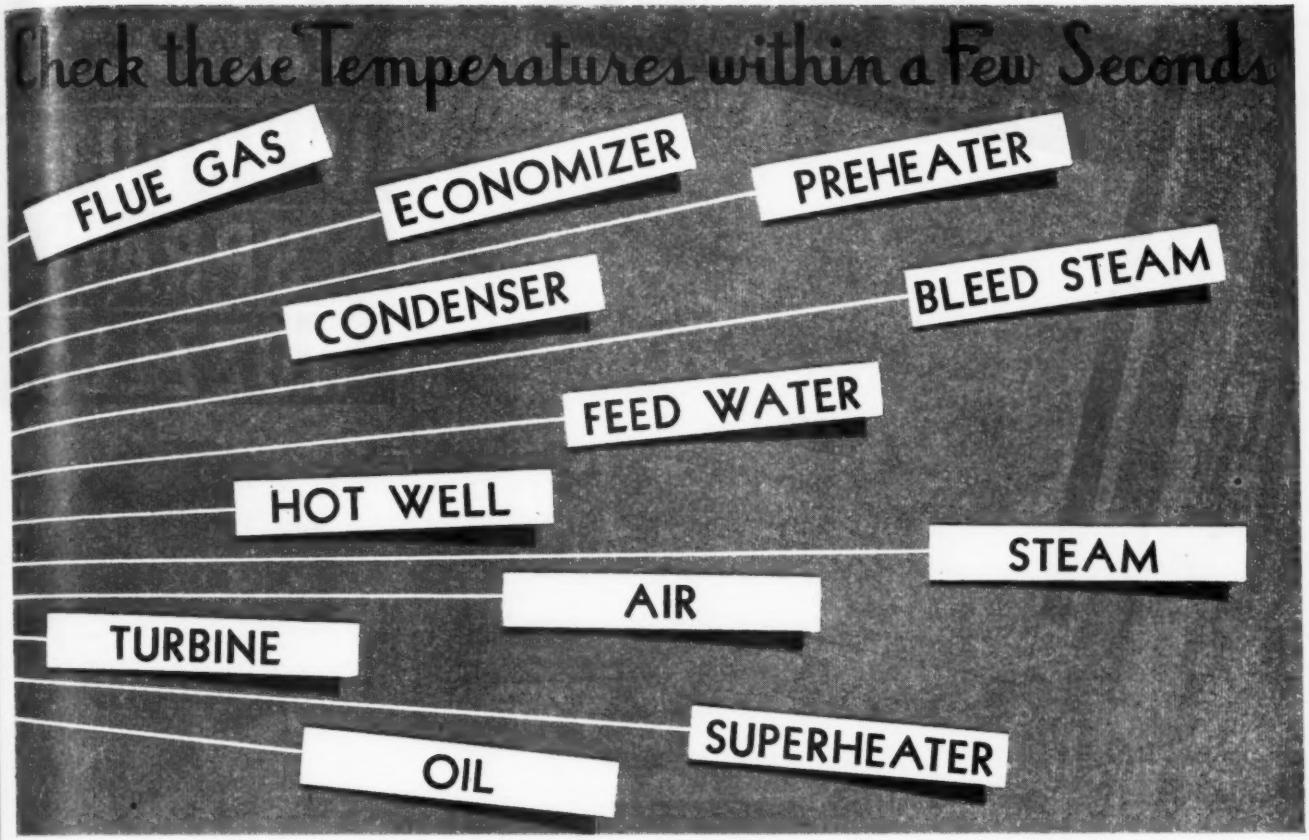
Instead of the usual galvanometer and its associated mechanisms, the entire system is an electronic one—a compact assembly consisting of a Conversion Stage and Amplifier.

Any unbalance between the thermocouple and slide wire voltages, as caused by a temperature change at the thermocouple, is converted into a polarized alternating voltage which causes the balancing motor to turn either clockwise or counter clockwise.

The motor in turn drives a gear which is *directly connected* to an Indicating Pointer, Recording Pen, and slide-wire connector. Hence, the balancing motor instantly readjusts the contactor to a new position balancing the measuring circuit.

The balancing operation continuously keeps pace with changes in the thermocouple voltage —there being no cyclic mechanical motion, no delay is introduced before corrective action is taken.

Brown



Free Your Operator From Tedious Routine

The self-balancing Centralized Reading Indicator pictured above is as modern as jet propulsion. The operator merely touches the desired switch. The instrument does the rest, leaving his hands free to log readings.

Time required between readings is limited *ONLY* by human ability to pick off a reading. Compare this time to that required to read an outmoded *manual* balance indicator, designed when shaving mugs were on every barber shop shelf.

The Brown Centralized Reading Indicator is unique for other reasons too.

The electronic "Continuous Balance" principle delivers sensitivity previously unheard of. Fancy being able to read one part in twenty-four hundred!

The ElectroniK is totally unaffected by vibration—mount it on a pulverizer frame if it suits your purpose.

The ElectroniK utilizes circular instead of reciprocating motion. Components move only when the scale is changing position.

Specify the Brown Precision Indicator for that post-war boiler.

Specify it, too, for your present station. Utilizing the same wiring and thermocouples, it readily replaces old-fashioned instrumentation.

For information write THE BROWN INSTRUMENT COMPANY, a division of Minneapolis-Honeywell Regulator Company, 4490 Wayne Avenue, Philadelphia, Pa. Offices in all principal cities. 119 Peter St., Toronto, Canada; Wadsworth Road, Perivale, Middlesex, England; Nybrokajen 7, Stockholm, Sweden.

Electronik POTENTIOMETERS

Proved power and endurance for cleaning small tubes

The Roto Company
Newark, N. J.

Gentlemen:

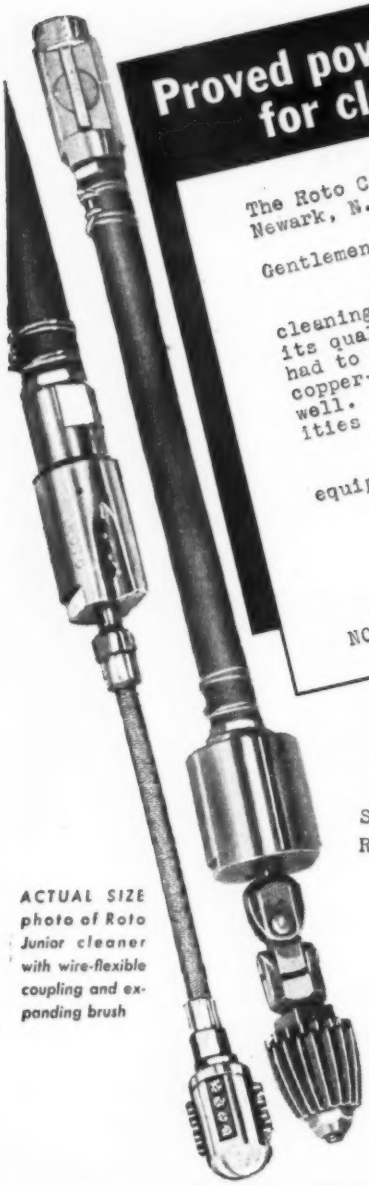
On receipt of your miniature tube cleaning equipment, I was a bit dubious of its qualifications to carry out the job it had to do. It has cleaned 4,000 3/4"x 24' copper-nickel tubes, and has done this job well. All suspicions of its staying qualities have been removed.

I can heartily recommend this equipment. Thanking you.

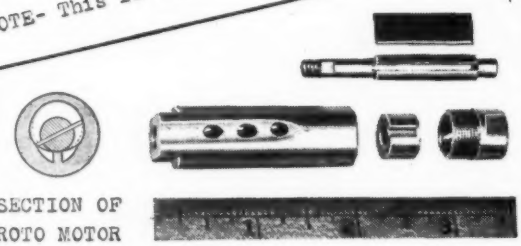
Yours respectfully,

(Signed) Chief Engineer
(Large municipal power plant)

NOTE- This is unsolicited



ACTUAL SIZE photo of Roto Junior cleaner with wire-flexible coupling and expanding brush



SECTION OF ROTO MOTOR

of the power and endurance of the Roto Junior Tube Cleaner is its extreme simplicity of design and precision construction. It has only two moving parts, a shaft and a solid blade. Positive contact between the blade and the Rotocentric bore cylinder assure an undivided air stream and freedom from leakage. Its convenient size, speed and ease of operation, offer a marked contrast with old type, cumbersome external cleaners. Send for details.

ROTO Junior Tube Cleaners

The ROTO Company, 145 Sussex Ave., Newark 1, N. J.

A DIVISION OF ELLIOTT COMPANY

YARWAY INVOLUTE SPRAY NOZZLES

Unique Yarway Involute design.

No internal parts or vanes to clog or erode.

Unobstructed flow gives minimum loss of head.

Finely divided spray cone provides rapid cooling.

Renewable orifices adapt nozzles for any service.

Installations total more than 5 million gallons per minute in water cooling and air conditioning service.

Made in both cast and bar-stock types. All sizes from ¼ in. to 2½ in. Write for Catalog N-616.

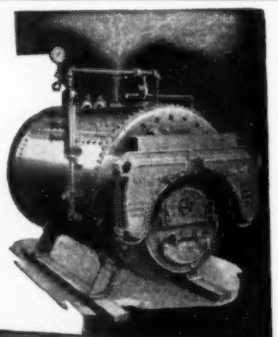
YARNALL-WARING COMPANY
100 Mermaid Ave., Philadelphia 18, Pa.

KEWANEE

SCOTTIE JR BOILER

5 sizes for small industrial usage. 9.9 to 30 H.P. Conveniently compact, yet easily accessible. Low in cost—economical to operate.

75 Years Boilermakers



For 6" scale with pipe diameter marking, write Department 99-K11.

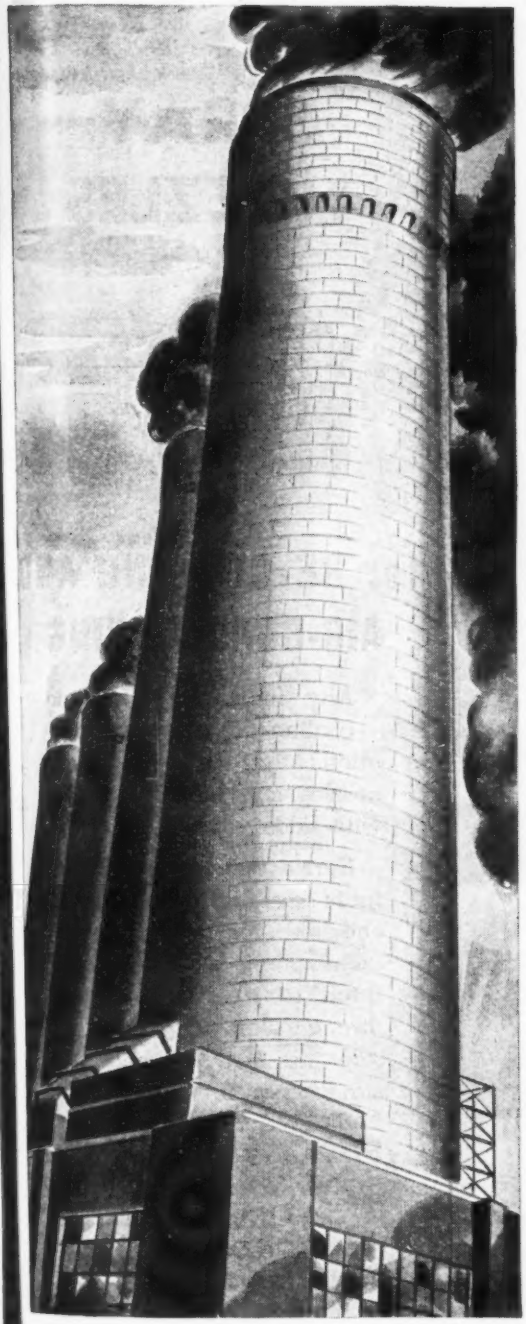
KEWANEE BOILER CORPORATION Kewanee, Illinois

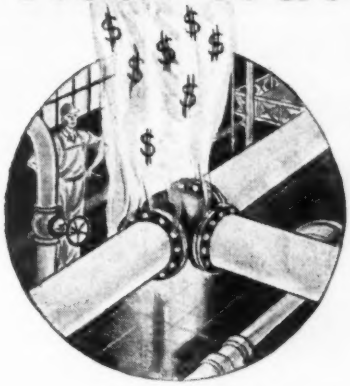
High Pressure Steam at Low Cost

Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION

SAVE WAR-VITAL FUEL!

Don't let it "Go up in Heat Waves"...





Fuel can be wasted not only by "going up in smoke", but also by "going up in heat waves"—in units of boiler-plant heat *lost through inadequate insulation.*

Today, with fuel demands at a higher-than-ever peak, industry must conserve every B.T.U. in its production of heat and power.

Power plants throughout the nation—public utilities, war and general industries — are obtaining maximum kilowatt production from minimum fuel with the aid of "always dependable"

Carey HEAT INSULATIONS

Carey's large production facilities—nationwide distribution service and specially trained engineers and erection crews of the Carey Contract Organization insure completion of your insulation jobs on schedule. No job too large or too small. Write for information to Dept. 16.

THE PHILIP CAREY MFG. COMPANY
Lockland, Cincinnati 15, Ohio

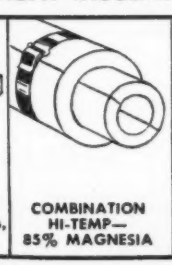
Dependable Products Since 1873

In Canada: The Philip Carey Co., Ltd., Office and Factory: Lennoxville, P. Q.

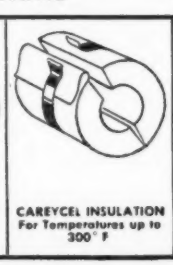
CAREY HEAT INSULATIONS

▶ *COMPLETE LINE OF HEAT INSULATIONS* ▶ *NATION-WIDE DISTRIBUTION* ▶ *TRAINED SERVICE AND ERECTION CREWS*

HI-TEMP BLOCKS For Furnaces, Ovens, Kilns, etc.

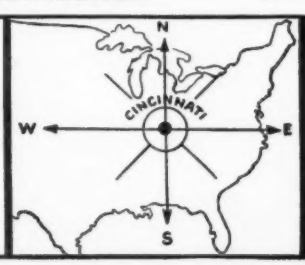


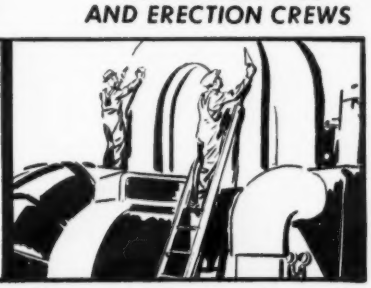
COMBINATION HI-TEMP—85% MAGNESIA



CAREYCEL INSULATION For Temperatures up to 300° F

85% MAGNESIA For High and Medium Pressure





Make Your Overhead Valves SAFE And Easy to Reach---

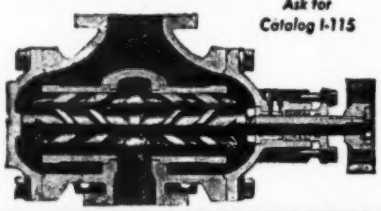
With the Babbitt Rim for Valves you eliminate danger and banish the step ladder. You can now place your valves wherever they come economically and conveniently. They fit any valve. Let us tell you more about them. Write today.

BABBITT STEAM SPECIALTY CO.
New Bedford, Mass.

IMO *Reliability* IN NAVAL SERVICE

The reliability of IMO "lube" and fuel oil service pumps is typified by their trouble-free performance on a United States Destroyer reported to us by the Navy as having steamed over 84,000 miles on convoy duty during the past year, often cruising as much as 28 days per month without time for normal upkeep and overhaul.

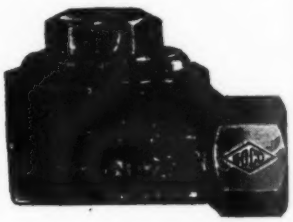
Ask for Catalog I-115



IMO PUMP DIVISION
of the De Laval Steam Turbine Company
Trenton 2, New Jersey

EDCO

SPRAY NOZZLES



for RE-COOLING AND AIR-CONDITIONING

Any industrial atomizing —cooling—or washing operations that call for spray nozzles can be done *better* with Edco.

Here's why: every EDCO tip is carefully designed and checked for spray angle, atomization and actual rated capacity — goes through rigid inspection before the EDCO diamond is stamped on it.

EDCO *is furnished in*

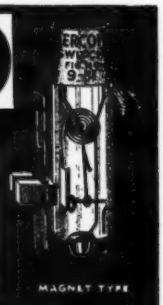
STAINLESS STEEL
BRONZE
NITRALLOY
MONEL
STONEWARE
HARD RUBBER

For savings offered by EDCO write at once for Booklet 3C1.

EDDINGTON METAL SPECIALTY CO.
P. O. Box K **Eddington, Pa.**

MERCOID

The Only 100% Mercury Switch Equipped Controls

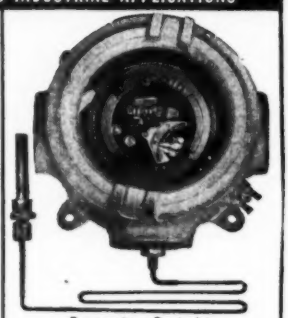


FOR HEATING, AIR CONDITIONING, REFRIGERATION, AND VARIOUS INDUSTRIAL APPLICATIONS

Pressure Control

Designed to automatically regulate electrically operated equipment in accordance with changes in temperature, pressure, vacuum, fluid level or mechanical movement.

Mercoid Controls have many desirable features which have made them favorites among leading industrial engineers.



Temperature Control in Explosion-proof case

DA (Double Adjustment) Temperature or Pressure Controls are used extensively on industrial applications. The outside double adjustment facilitates the control operating range setting. The calibrated dial plainly indicates the desired setting. All guesswork is eliminated. No cover to open or remove when making control adjustments. A locking device is provided to prevent tampering. Various ranges available.

The hermetically sealed mercury switches are dust and corrosion-proof. There is no open arcing, pitting or sticking of contacts. These switches assure better control performance and longer control life.

If you have a pressure or temperature control problem Mercoid engineers will assist you.

See catalog No. 600 for complete information on all types of Mercoid Controls.

THE MERCOID CORPORATION, 4225 BELMONT AVE., CHICAGO 41, ILLINOIS

"Follow the leader" is no kid's game

The way Toledo plays it!

● Zooming to the target... the squadron leader sets a gruelling pace for others to follow.

Industry, too, has its pace-setters—and in Pipe Tools for nearly half a century that leader has been TOLEDO!

It's been tough to be a leader... every leader knows that.

It means constant hard experimental work and research.

It means continual vigilance in every phase of our manufacturing...

And it means a fair sales policy—fair to the user—fair to the distributor.

But we like our role...for we know, that which deserves to lead leads.

And so you can expect the new things that really count to come from Toledo... *first!*

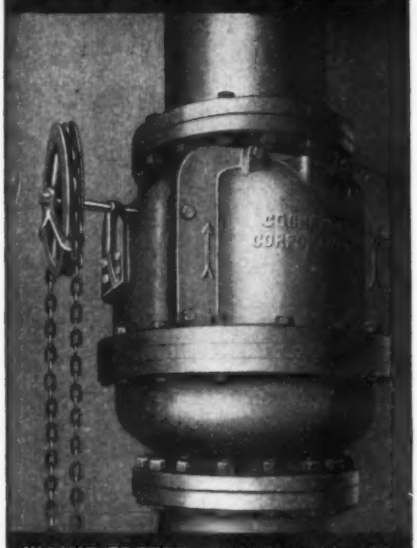
The Toledo Pipe Threading Machine Company, Toledo, Ohio. New York Office, No. 2 Rector St.

TOLEDO

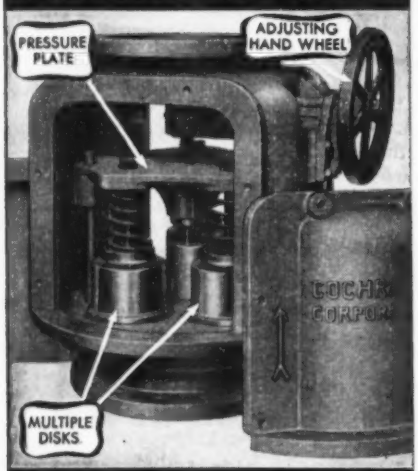
PRECISION PIPE TOOLS

Toledo SIMPACT—self-contained, adjustable threader for 1" to 2" pipe. Sizes changed instantly with one set high speed steel dies. Accurate, dependable.

WON'T STICK—WON'T JAM



WON'T FREEZE—WON'T CHATTER



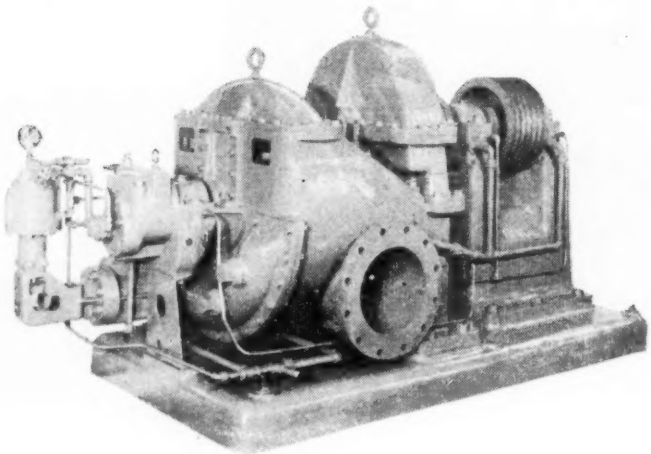
EASILY ADJUSTABLE

SAFETY silence and tightness are the outstanding characteristics of the Cochrane Multiport Relief Valve. A number of small disks, each with an independent holding-down spring, are used in place of a single disk. Thousands are giving satisfaction.

COCHRANE CORPORATION
3106 N. 17th Street, Phila. 32, Pa.

COCHRANE
MULTIPORT
RELIEF VALVE

MURRAY
STEAM TURBINES AND GEARS



In the smaller sizes, MURRAY recommends the use of the Type UG integral turbine-gear unit, for lowest steam consumption and moderate cost. Unless the slow speed apparatus to be driven is for standby operation only, the geared set will pay for itself in a short time.

Just compare its steam rate with that obtained by using a direct connected turbine.

Correct alignment of the gear and turbine bearings is assured, and is easily maintained, since expansion of the exhaust casing is allowed by machined pads and bolts, located at the center-line, holding the turbine and gear casings, together with the sliding dowel, which allows expansion.

The pinion and turbine shaft are forged in one piece. The gear may be solid forged, or built-up, using a forged rim and cast center. Depending on face width, the gears are single or double helical.

The unit shown is equipped with direct-acting variable speed governor, and drives a reciprocating ammonia compressor in an eastern food processing plant.

For turbines from 10 horsepower to 2500 kilowatts rating —refer to our nearest representative.

MURRAY IRON WORKS COMPANY
BURLINGTON, IOWA
Builders of Steam Power Equipment for Three Quarters of a Century

"Aircraft Quality" GEARS

For the products you are now manufacturing or planning to manufacture, you should know about the many advantages of Foote Bros. "aircraft quality" gears.

These gears were developed to transmit the loads of giant aircraft engines, and the essential demands of high speed, compactness and light weight required a precision in manufacture that amounted to almost theoretical perfection.

Today at Foote Bros. four large plants, these gears are being produced in amazing quantities. The facilities of these plants, plus the "know how" acquired by Foote Bros. engineers and production men, offer manufacturers a new approach to "better power transmission through better gears" for their postwar products.

A new engineering production bulletin on these "aircraft quality" gears will aid your engineers in determining how they can best be applied to your product. Write for your copy today.

FOOTE BROS. GEAR AND MACHINE CORPORATION, DEPARTMENT V
5225 So. Western Blvd., Chicago 9, Ill.

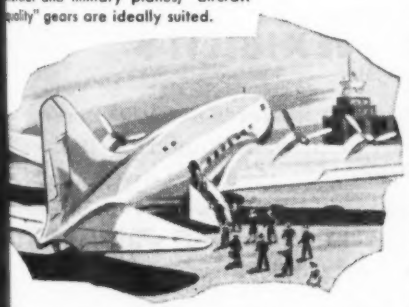
OFFER YOU THESE 5 ADVANTAGES

- ★ GREATER MECHANICAL EFFICIENCY
- ★ GREATER COMPACTNESS
- ★ HIGHER SPEED
- ★ REDUCTION IN WEIGHT
- ★ GREATER QUIETNESS

FOOTE BROS.

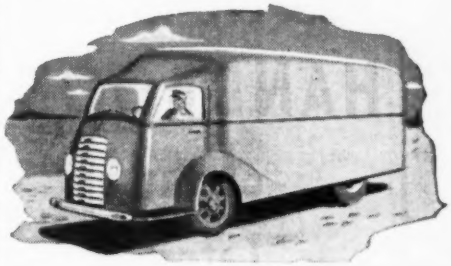
Better Power Transmission Through Better Gears

For actuators or other devices on commercial and military planes, "aircraft quality" gears are ideally suited.

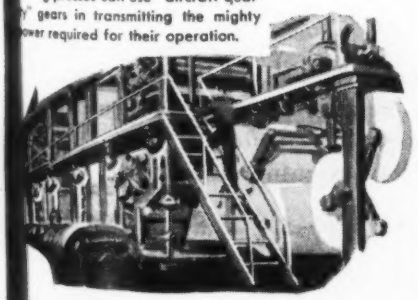


For airplane engines of every size, "aircraft quality" gears offer light weight, compact size, high speed.

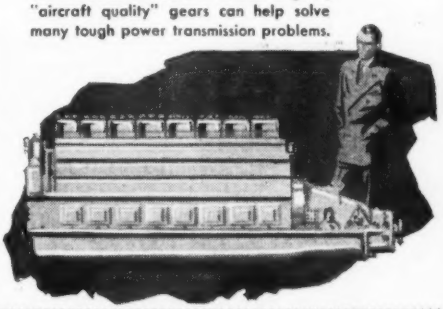
For internal combustion engines, "aircraft quality" gears transmit high speeds with a reduction of size and weight.



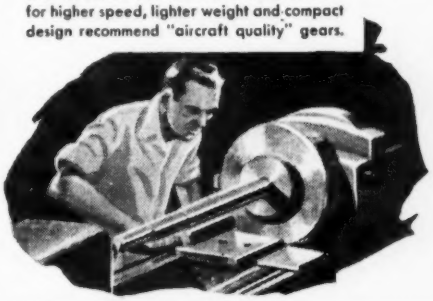
Printing presses can use "aircraft quality" gears in transmitting the mighty power required for their operation.



For the manufacturers of Diesel engines, "aircraft quality" gears can help solve many tough power transmission problems.

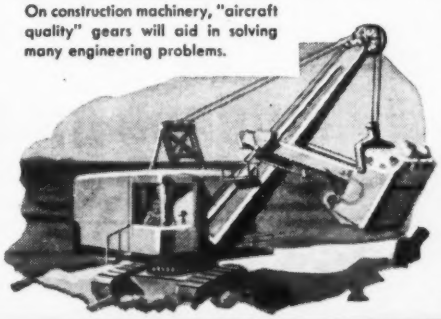


The demands of machine tool manufacturers for higher speed, lighter weight and compact design recommend "aircraft quality" gears.



Because of their ability to stand up under tough service, "aircraft quality" gears can aid in making tractors better.

On construction machinery, "aircraft quality" gears will aid in solving many engineering problems.



FOOTE BROS. GEAR AND MACHINE CORPORATION
5225 S. Western Blvd., Chicago 9, Ill. Dept. V

Please send me a copy of the Engineering Bulletin on "Aircraft Quality" Gears as soon as it is available.

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Position.....

Company.....

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City *State*

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Every Hercules Float carries our guarantee to stand up under 350 lbs. working pressure and 500 degrees temperature.

Fabricated of seamless copper under our special spinning process. Hercules Floats are uniform in thickness and high in mechanical strength.

You can depend on Hercules for floats—in standard shapes up to 10 in. and in special types to your specifications—to give long, dependable, economical service.

Insure care-free maintenance of water level in your heaters, tanks, reservoirs and other equipment by specifying "HERCULES."

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SPRINGFIELD, MASS.

Your Up-to-date
HANDBOOK of the Latest in Power-field Practice

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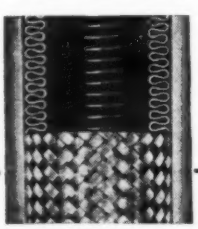
REX-WELD combines 8 other advantages with MAXIMUM FLEXIBILITY

REX-WELD is preferred by many designers and manufacturers. Because of its satisfactory performance under difficult conditions for long periods of time, maintenance requirements are reduced to a minimum.

In addition to providing maximum flexibility, REX-WELD is highly resistant to fatigue, handles burst pressures to 14,500 p.s.i. and temperatures to 1000° F., remains air-tight longer, is leakproof even after hard usage, can be used for liquids that are searching and will withstand prolonged flexing.

Chicago Metal Hose Corporation manufactures a type of flexible tubing to meet every requirement. Our engineers will be glad to recommend the type best suited to meet your particular requirements. Write for catalog and complete information.



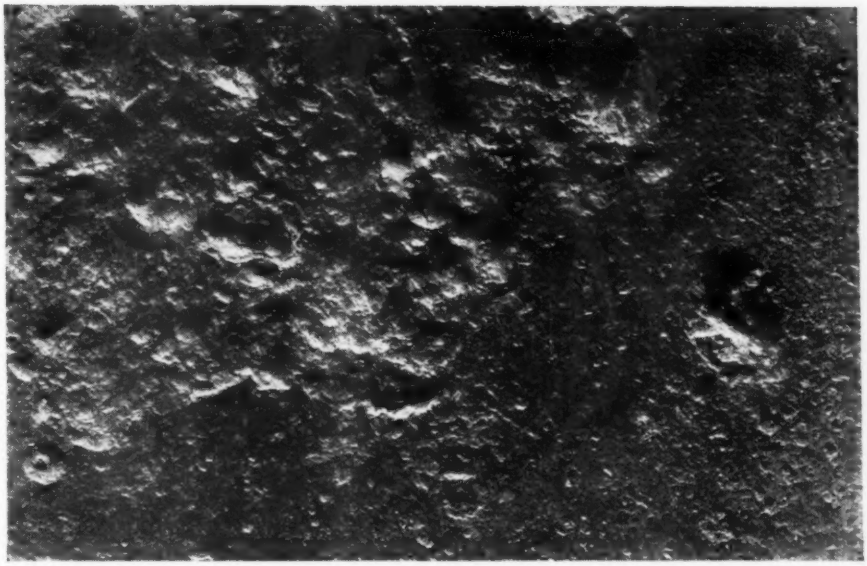
REX-WELD CORRUGATED FLEXIBLE METAL HOSE

Flexible Metal Hose for Every Industrial Use

CMH CHICAGO METAL HOSE CORPORATION
MAYWOOD, ILLINOIS
Plants: Maywood and Elgin, Ill.

Fight The Scourge Of Boiler Metal With APEXIOR

APEXIOR provides an impenetrable barrier against corrosion that frequently leads to inefficient operation — costly shutdowns — wasted manpower and horsepower.



Boilers and other equipment exposed to contact with hot water and steam at high temperatures are being effectively protected from premature old age by applications of APEXIOR NUMBER 1. Even some boilers on the inactive list have been returned to service with the help of this thoroughly tested protective coating. In all cases, APEXIOR has extended the period between cleanings and made cleaning much easier and quicker.

APEXIOR—THE PAINT THAT TAKES THE WEAR

APEXIOR NUMBER 1 is a chemically inert "film of safety" for boiler tubes, drums, economizers, and steam turbines. Brush-applied, it fills in the metal pores and joints shutting out water completely. There is less adherent scale, so the problem of scale removal is simplified.

APEXIOR'S tough, smooth surface — not the metal — takes the wear. One application lasts 2 to 3 years or more. It is easily renewed.

Painting boiler metal with APEXIOR is recommended by boiler insurance companies. And many manufacturers of turbines coat shafts, rotor bodies, and frequently interiors of casings with APEXIOR before shipping to customers.

Hundreds of industrial power plants, utilities, railroads, and marine operators have relied on APEXIOR to aid them in fighting the scourge of boiler and turbine metals. It is helping them through this critical period in their history. APEXIOR can do likewise for you . . . prolong the life of your boilers or any equipment having hot wet surfaces . . . conserve manpower and vital materials . . . see you through the war period.

Here are some of the many companies now benefitting by APEXIOR

Hercules Powder Co.
Narragansett Electric Co.
Westinghouse Electric & Mfg. Co.
American Sugar Refining Co.
Tennessee Eastman Corp.
The Pullman Co.
Duke Power Company
Ford Motor Co.
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See how easily APEXIOR can be applied

Write today for Bulletin 1290 (Industrial) or 1305 (Marine) giving complete details on peak protection for peak production.

APEXIOR

A Peacetime Plus ★ ★ ★ A Wartime Must

RECOMMENDED BY ALL U. S. AND CANADIAN BOILER INSURANCE COMPANIES

The **DAMPNEY COMPANY of America** *protective coatings for*

STATIONARY BOILERS, LOCOMOTIVES AND STEAMSHIPS

THE DAMPNEY COMPANY OF AMERICA
Hyde Park 36, Mass.

Please send free Bulletin 1290 (Industrial) ☐ 1305 (Marine) ☐

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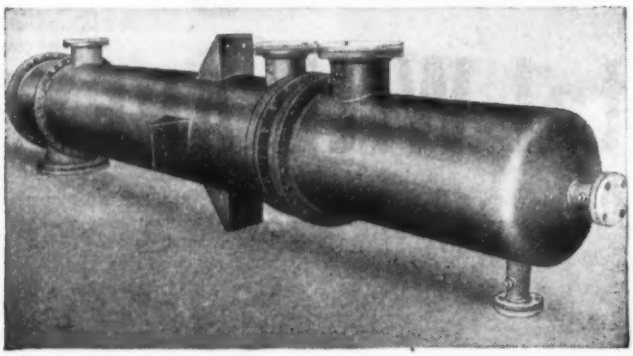
Engineering Sales Representatives — Pittsburgh, Cincinnati, New Orleans, San Francisco, Los Angeles, Portland, Seattle, Phoenix, Denver, Salt Lake City, Dallas, Houston, Vancouver, B. C., Montreal, P. Q., Havana, Cuba, Honolulu, T. H., Marine Dept., 115 Liberty Street, New York, N. Y.

IT'S NOT ON THE PRINT . . .



BUT IT'S *IN* THE PRODUCT

A blueprint is concerned only with design and specifications.

We concede the importance of good design and intelligent specification of materials, but Downingtown's ability does not stop there.

Our specialized knowledge of fabrication, proper methods of procedure; complete, modern plant facilities and wide experience in manufacturing are not blue-printed, but they do show up in the finished product.

Our Engineering consultation is at your disposal. Downingtown Heat Transfer division has prepared a handbook which will be ready for free distribution on or about Sept. 15th. Send for a copy of this handy reference book, on your business letterhead, please.

DOWNINGTOWN IRON WORKS
DOWNINGTOWN, PA.
HEAT EXCHANGERS

THESE VERSATILE

Models *KDP* and *ODP*—

POPULAR LONERGAN *BRONZE*

SAFETY VALVES

Are Used All Through Industry for Pressure Safety Protection on—portable and stationary boilers . . . on heat exchangers, kettles, tanks, and steam lines . . . on air compressors, Diesel engine systems, and on many other types of pressure equipment. These valves are nationally recognized for quality, workmanship and dependability.

KDP is a top-outlet valve. *ODP* has a side outlet so that the discharge can be piped away.

Both valves conform to A. S. M. E. Code requirements, and are National Board approved.

For further details, write for copy of our Bulletin 501-A—which also describes the complete modern line of Lonergan Iron and Steel Safety Valves for all types of boilers.

Sales and engineering service is available through LONERGAN representatives located in principal cities . . . there are distributors to serve you in every important industrial center.

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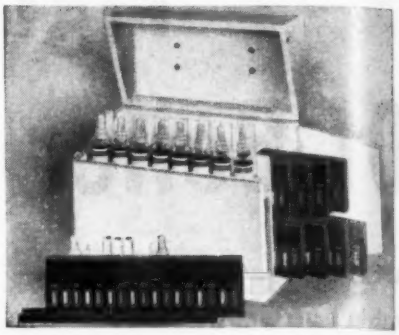
SAFETY VALVES • RELIEF VALVES • PRESSURE GAUGES • SPECIALTIES

TAYLOR-*Standard of Accuracy*



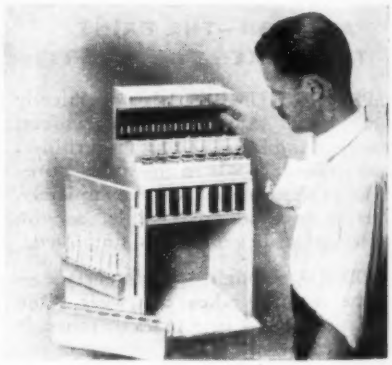
LONG RANGE COMPARATOR

Big Help

AROUND PLANT

This outfit gives you all the facilities for determining pH as an aid to increasing the efficiency of your power producing equipment by preventing deterioration of boiler and pipes, etc. Includes comparator base and any 3 color standard slides of durable non-warping plastic, and all necessary accessories. Compact carrying case will hold 6 extra slides, within the range pH 0.2 to 13.6.

Price, complete with any 3 slides.....$42.00
F.O.B. Baltimore. Extra slides, each.....$8.00



DALITE pH Comparator

Just the outfit for all routine testing. A completely self-contained unit for immediate use night or day. Neat wooden carrying case contains model T-O comparator base (which sits on shelf in front of dalite glass) special bulb, any 3 to 8 color standard slides, and all accessories. Absolutely accurate, for all Taylor liquid color standards carry an UNLIMITED GUARANTEE against fading.

Dalite pH Slide Comparator, complete with 3 color standard slides..$50.50 F.O.B. Baltimore

See your dealer or write for Free Booklet

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It's "PLANT" for ENGINEERED INSULATION

Each "PLANT" Contracting-Unit collaborates with engineers by furnishing specifications and details for the proper application of our insulating materials at any temperature.

An organization, like a man, is known by the company it keeps. The list of "Plant" customers is long and impressive indeed; the type of work is wide and varied.

The "Know-How" of the PLANT Contracting-Unit is carefully coordinated with the experience of our three Pacific Coast factories. Customers derive the full benefits of 24 years of successful, responsible contracting and manufacturing experience.

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Here's the universal packing that can be used for any fluid or on any apparatus. One size packs all—economically, efficiently—tightly—simply.

Try ALLPAX and you, too, will be enthusiastic over its easy application and long wear. You don't have to remove old packing to repack with ALLPAX. Square cross section makes ALLPAX easy-filling in any stuffing box.

Try it and you'll always use it. Full details on request.

TUBE CLEANERS

The possibility of stalling your tube cleaner motor when cleaning tubes in which deposits of uneven thickness are found is minimized when a Wilson EP Series Air Motor is used. Its extra power and high torque permit it to operate efficiently where other motors won't go. This feature means time, labor, money and materials saved in tube-cleaning.

The reason for this extra power lies in the special valve design of the EP Motor. Full use of air with minimum back pressure, leakage and friction, together with its six-blade light-blade construction provide the smooth flow of high power to prevent stalling.

The EP Series Motor in the photograph above is shown with a Type F cutterhead for removing a large variety of tube deposits.

Thomas C. Wilson, Inc. maintains a large research staff which has developed many tube cleaners and accessories for removal of every type of deposit. A bulletin describing the complete Wilson line will be sent on request.

MODERN TUBE-CLEANERS FOR THE PROBLEMS OF TODAY

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PIPE AND TUBE CLEANERS EXCLUSIVELY

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Extra strength, safety—*plus* easier maintenance—are due to the low-temperature, pressure-welding of hot rolled steel Hex cross bars to main bars. These qualities are obtainable only by using the Hex, fillet-welded design . . . and they cost nothing extra.

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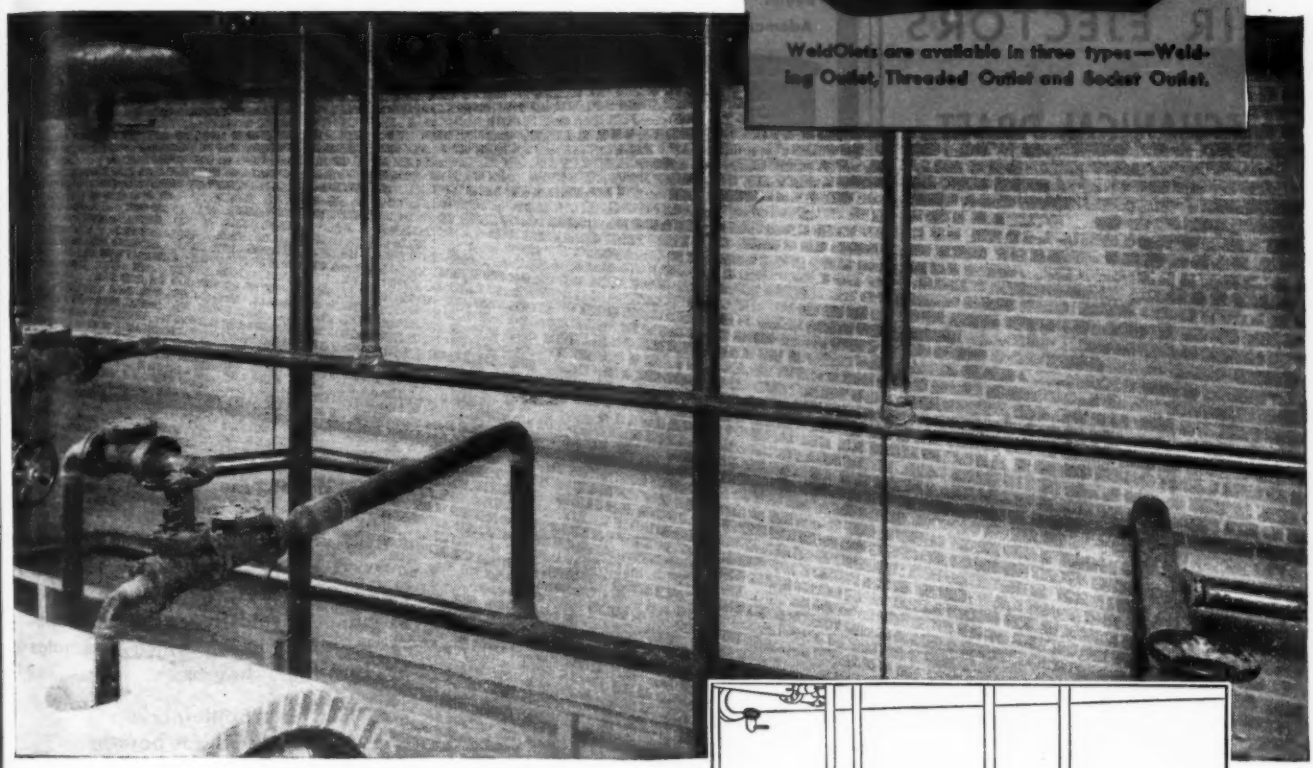
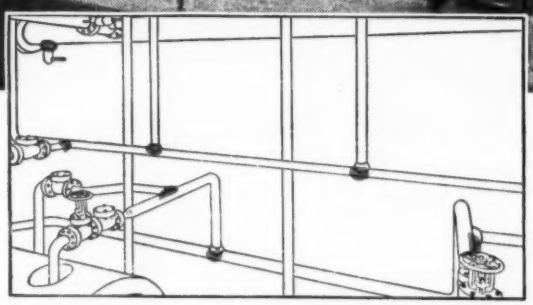
WALTER BATES COMPANY, INC.
JOLIET • ILLINOIS
OPEN STEEL FLOORING • STAIR TREADS

How To Maintain FULL PIPE STRENGTH At Branch Outlets.

WeldOlets are available in three types—Welding Outlet, Threaded Outlet and Socket Outlet.





In a pipe job like this, branch pipe outlets must maintain the strength of the original pipe to insure safe, permanent, leak-proof joints. This is done easily by the WeldOlet method. These drop-forged fittings are shaped to fit the run pipe and are designed to provide ample reinforcement at the joint for pressures up to 400 lb. at 750° F. The factor of safety, under internal pressure, is equal to that of the pipe itself.

In addition, the scientifically designed funnel shaped opening of the WeldOlet permits unobstructed flow and a minimum of pressure loss due to turbulence and friction.

WeldOlets are available in size-to-size and reducing sizes from ¼" to 24". For information on the complete line, send for Catalog.

Forged Fittings Division • BONNEY FORGE & TOOL WORKS • 342 Green St., Allentown, Pa.

WELDOLETS
TRADE MARK REG. U. S. PAT. OFF.
PAT. IN U. S. & FOREIGN COUNTRIES
WELDING OUTLET - THREADED OUTLET - SOCKET OUTLET
For Welded Branch Pipe Outlets

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OF PHILADELPHIA

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by laying up furnace linings with Adamant . . . the fire brick cement of proved great bonding strength.* Adamant actually welds the brick together . . . protects the construction at the joints where failure usually begins.

Adamant has been proven STRONGER by test . . .

Impartial laboratory tests showed Adamant has a bonding strength of 800 lbs. at room temperature; 1270 lbs. at 2600° F. Adamant has a P. C. E. of 3000° F. plus. For more details, write

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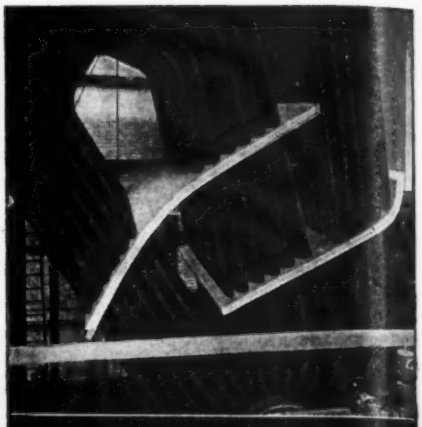

Streamlining
SAVES
PRECIOUS
FUEL

STREAMLINE the flow of gases across the boiler tubes and you get more steam from less fuel. That is what Enco Baffles do. They use scientifically curved baffle surfaces instead of sharp angles. They taper the passes to maintain velocity as the gases decrease in volume, which promotes heat-transfer. They:

- Eliminate bottle-necks
- Abolish dead gas pockets
- Reduce draft losses
- Speed heat transfer
- Keep heating surfaces cleaner
- Cut down use of soot blower
- Provide for tube expansion and replacement

Adaptable to any type of water-tube boiler, fired with any fuel. Designed for each individual installation. Only selected materials used. Installed by skilled mechanics. Send for Bulletin BW 44.

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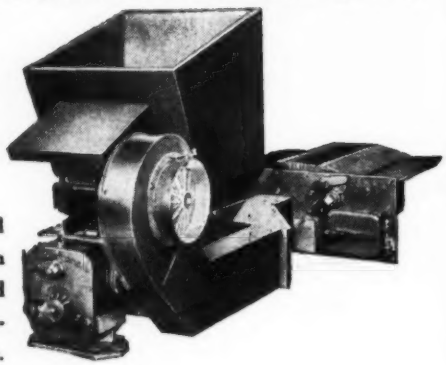
Streamline
Baffles
Produced exclusively by The Engineer Co

This Frederick Stoker . . .
will pay you
dividends



Every purchasing agent . . . all plant engineers interested in keeping fuel costs down should investigate the money saving possibilities of this two-fisted stoker.

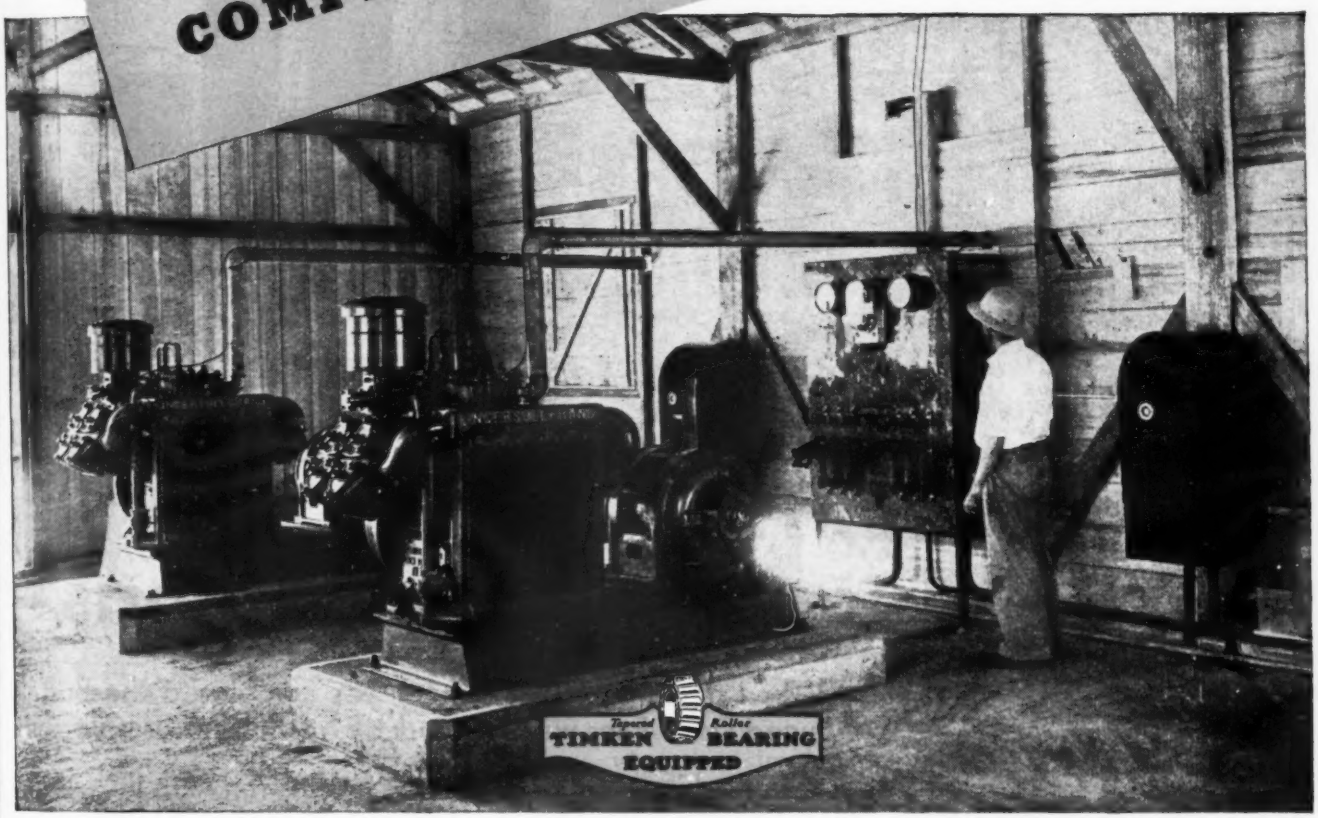
Designed and constructed to get maximum heat from every ton of coal burned, the fuel conserving qualities of the Frederick stoker are the result of more than 25 years' experience in the production of industrial stokers that keep coal bills at a minimum.

This experience, coupled with our engineering knowledge—plus a real understanding of industry's needs, combine to produce an efficiently operated stoker that is reducing fuel consumption and earning money for a host of satisfied users.

Investigate the possibilities of the Frederick stoker . . . write for your copy of our Stoker catalog . . . now.

THE Frederick IRON & STEEL CO.
Frederick, Maryland
Stoker Specialists Since 1918

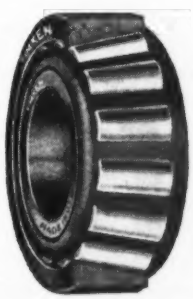
TIMKEN BEARING EQUIPPED COMPRESSORS at Rio de Janeiro



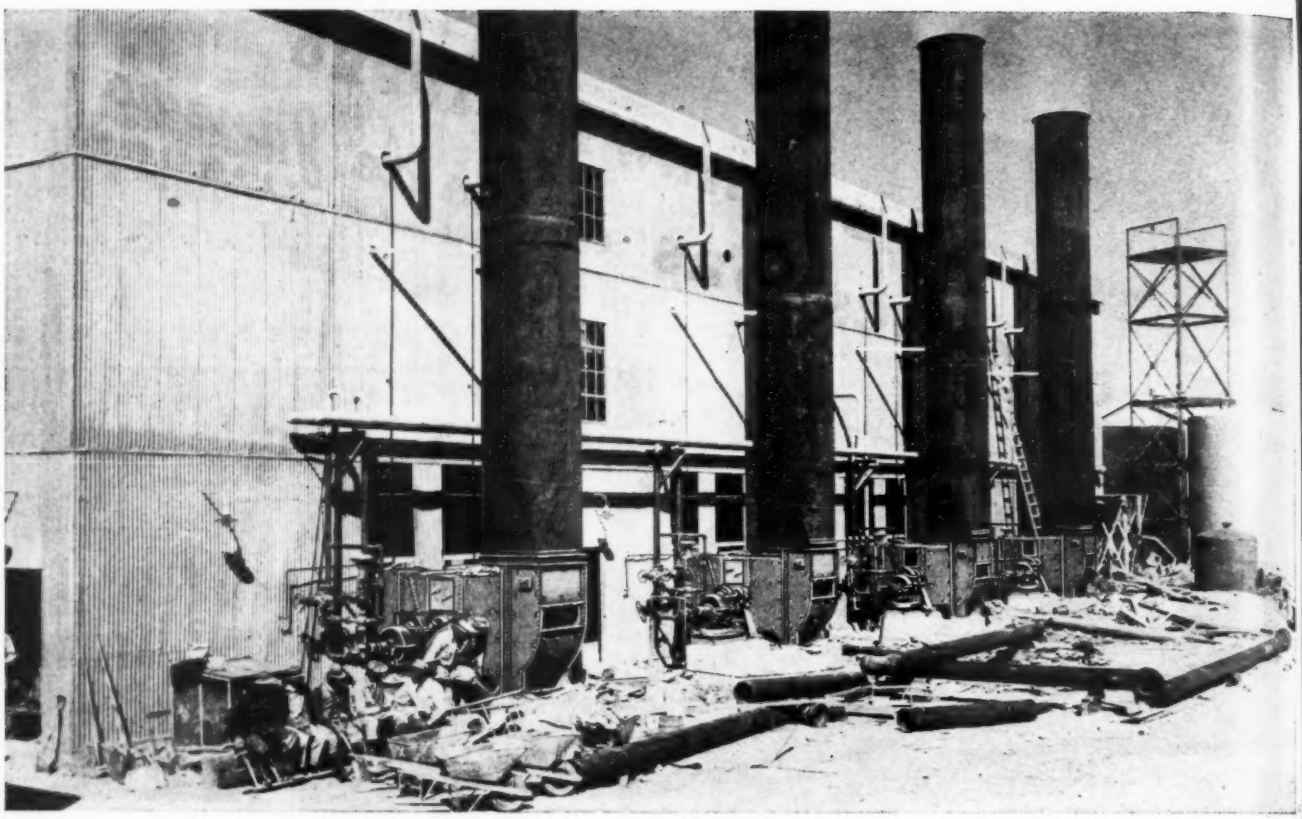
The two Ingersoll-Rand Model 50B Type 40 Compressors shown in the photograph, were installed to furnish air for quarry and general excavation work in connection with the building of the new National Steel Plant, Volta Redonda, Rio de Janeiro. They are equipped with Timken Tapered Roller Bearings on the main crankshafts.

Ingersoll-Rand Company has been using Timken Bearings on various models of compressors for years and knows they can be relied upon to furnish anti-friction advantages in full, including smooth operation; prevention of wear on crankshafts; protection against radial, thrust and combined loads; and maintenance of crankshaft alignment under all conditions.

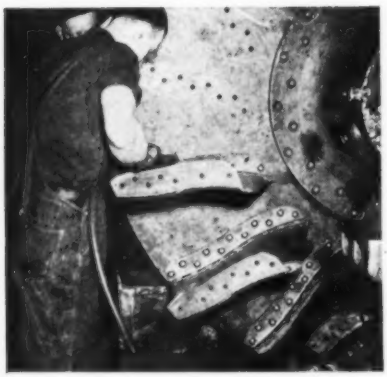
When buying an anti-frictionized compressor of any type specify "Timken Bearing Equipped" and be sure of getting anti-friction performance at its best. The Timken Roller Bearing Company, Canton 6, Ohio.



TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS



Built to weather tough operating conditions—



Building power plant fans is an art-requiring first, proper design, second suitable materials, third, skilled workmen. When you buy Buffalo Draft Fans, our 66 years of fan building experience assures you of all three requirements.

"FAN ENGINEERING"
740 page Fan Engineers handbook.
$4.00 postpaid in U. S. A.
SEND YOUR ORDER.

When this Texas Oil Refinery was completed the Buffalo Induced Draft Fans went to work on a twenty-four hour shift.

Rain or shine, hot or cold—these fans run with little or no attention—helping to produce a vitally needed war product.

"Buffalo" Fans are selected for these tough jobs because they have the heavy duty construction which is required under such conditions.

In your plant, they will give the same reliable efficient performance. Why not have them?

Buffalo Forge Company

488 Broadway **Buffalo, N. Y.**

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

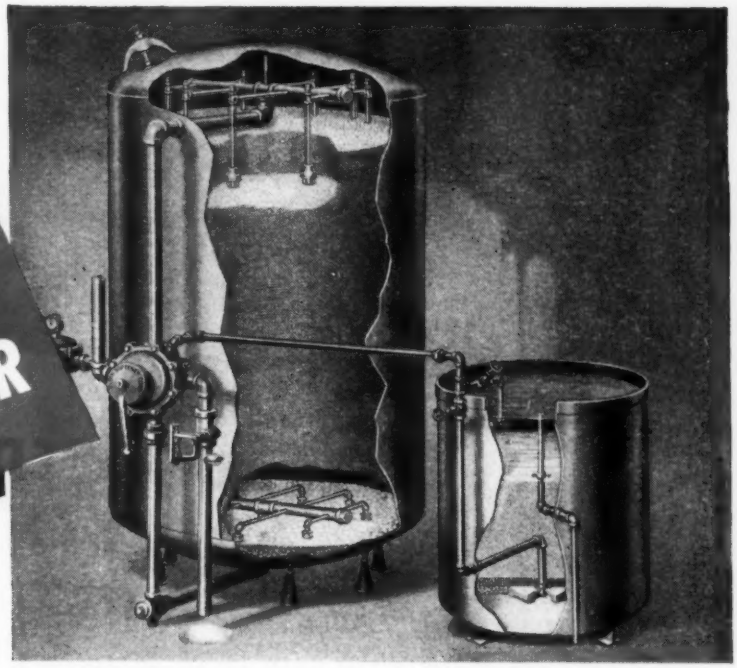
"Buffalo" "First For Fans"

draft fans

NOW AVAILABLE

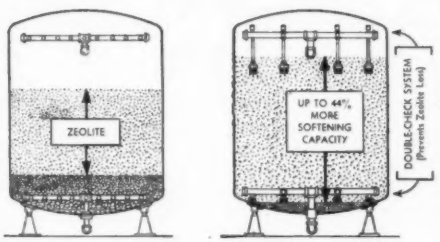
postwar design

ELGIN WATER SOFTENER



. . . delivers up to 44% more soft water

NOTE THE INCREASED CAPACITY



ORDINARY WATER SOFTENER DESIGN — ELGIN WATER SOFTENER DESIGN

HERE'S HOW TO STEP UP THE OUTPUT OF YOUR PRESENT WATER SOFTENER

The "Double-Check" equipment can be installed in place of the present manifold in your zeolite softener regardless of make. This change, along with Elgin High Capacity Zeolite, will give you greatly increased soft water output. The cost of this modernization is surprisingly low. Let us give you facts.

• Here's real news for users of zeolite water softener equipment. Our postwar design is now available. It delivers up to 44% more soft water than any other unit of equal size. Of importance is the fact that this new water softener has been fully proved by gratifying results in a long list of plants where it is already in service.

An improved double-check type manifold prevents the escape of zeolite and therefore permits placing a far greater amount of water softening zeolite in the softener, as shown. More zeolite means more soft water output—for it's the zeolite that does the softening.

But that isn't all. A higher backwashing rate is also made possible by preventing loss of zeolite. This higher rate cleans the softener thoroughly. With the zeolite bed clean, the salt reaches every grain of zeolite. The result is better regeneration with less salt consumption . . . higher over-all efficiency.

The whole story of tomorrow's water softener today is told in brand new bulletin 606. Write for your copy today.

ELGIN *economical water conditioning*

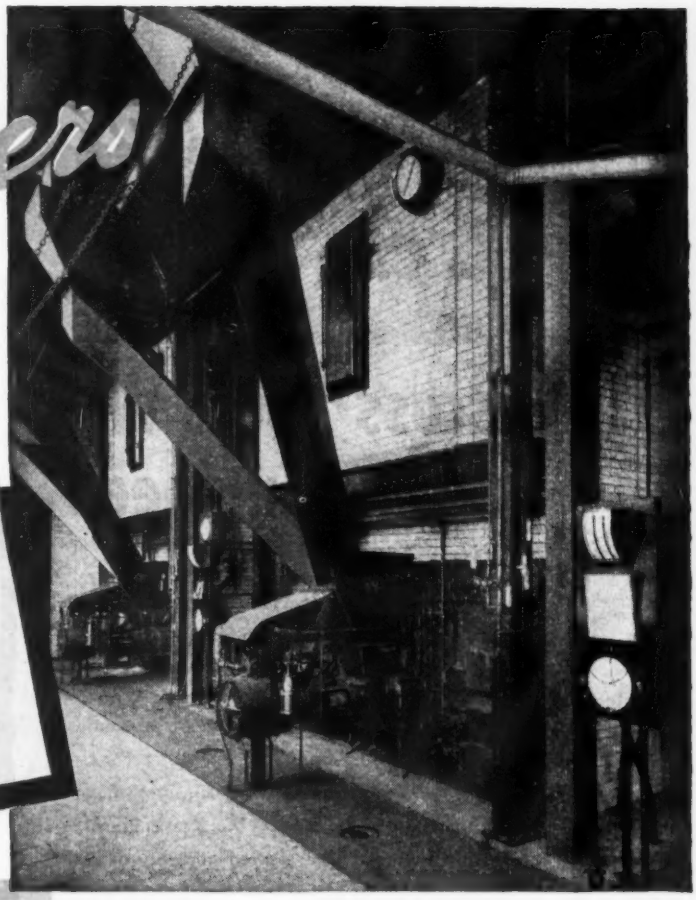
The complete Elgin line—Boiler Water Treating and Purifying Systems • Feedwater Treatment • Deconcentrators • Heat Exchangers • Water Softeners • Filters and Purifiers • Iron Removal Equipment • Aerators • Water Treating Chemicals • Chemical Feeders • Scale and Corrosion Inhibitors • Sample Coolers • Water Testing Equipment • Zeolites

ELGIN SOFTENER CORPORATION, 130 NORTH GROVE AVENUE, ELGIN, ILLINOIS

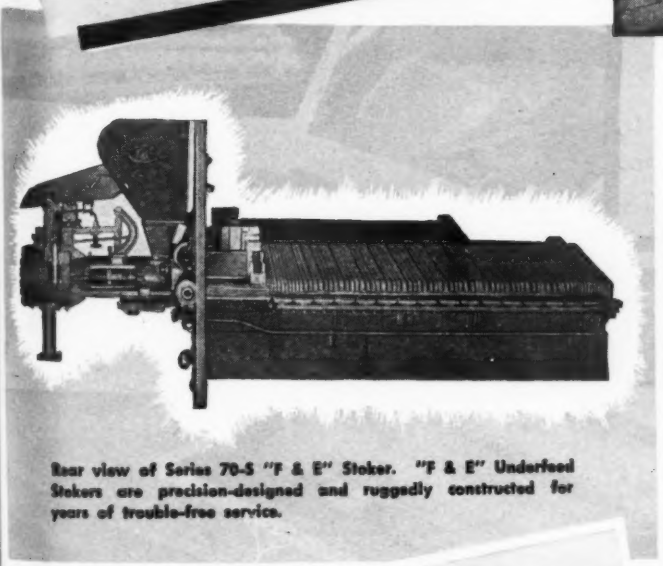
CORRUGATED PIPE
AND BENDS
ADAPTABLE • LESS STRESS • SAVED SPACE
In problems involving high forces or moments due to thermal expansion, Navco Corrugated Pipe and Bends are frequently the only solution.
By reducing the bending stresses and minimizing the end reactions, a safe design is insured which perhaps could not otherwise be obtained.
Whenever you have any unusual Piping problems, consult Navco.
NATIONAL VALVE & MFG. CO., PITTSBURGH, PA.
ATLANTA BOSTON BUFFALO CLEVELAND CHICAGO NEW YORK PHILADELPHIA
NAVCO
NAVCO PIPING

"F&E" Stokers

HANDLE HEAVY DUTY JOB FOR PENNSYLVANIA SANITARIUM



TWO SERIES 70-S UNDERFEED STOKERS HAVE PROVIDED UNINTERRUPTED FIRING FOR 4 YEARS AT LEECH FARM TUBERCULOSIS SANITARIUM, PITTSBURGH, PA.



Rear view of Series 70-S "F & E" Stoker. "F & E" Underfeed Stokers are precision-designed and ruggedly constructed for years of trouble-free service.

Just one glance at the plant that generates steam for this large sanitarium tells you that it is a model of efficiency. The two 400 H.P. 3-drum, bent tube boilers call for steady firing . . . and "F & E" direct steam drive stokers more than meet this requirement. Burning low-cost fuel, they make this an exceedingly economical installation.

This "F & E" Stoker installation is just one of many hundreds of installations that are turning in outstanding performances in industrial plants, public buildings, hotels, schools, housing projects and institutions the country over.

So, if you're planning new boiler room equipment, for now or postwar, have your consulting engineer get the facts on "F & E" Stokers from the "F & E" representative in your territory. He can give you facts that will amaze you.

ONLY "F & E" STOKERS HAVE ALL 6 OF THESE IMPORTANT FEATURES

1. Choice of Direct Steam or "F & E" Electro-Hydraulic Drive.
2. Patented "F & E" Interval Timer Governor for perfect control of fuel feeding rates.
3. Sliding Bottom Retort for even fuel distribution.
4. Exterior Fuel Bed Regulator.
5. Removable Ram Case Liner.
6. High Efficiency Tuyeres of heat-resisting metal.

F&E

UNDERFEED STOKERS

for boilers producing from 1,000 to 40,000 lbs. of steam per hour

are manufactured by

FLYNN & EMRICH CO.

Established 1842

HOLLIDAY & SARATOGA STREETS, BALTIMORE 2, MARYLAND

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Reconversion INVOLVES MANY SPECIAL *Heat Exchange* PROBLEMS

Discuss Yours With a ROSS Engineer

A heavy need for specially engineered heat exchangers is indicated in industrial rehabilitation.

Because this is going to necessitate sound analysis of your individual operating conditions and requirements, you can now make profitable use of the services of a Ross engineer. In this way, you'll be assured not only of reliable recommendations, but also of the careful Ross fabricating methods known to American industry for over 25 years.

Consult with the nearest Ross office, or write direct to the plant.

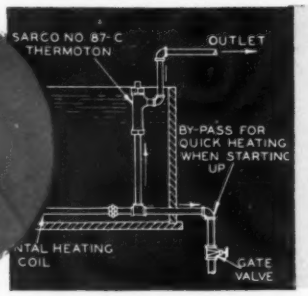
ROSS HEATER & MFG. CO., INC.

Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION

GENERAL OFFICES AND PLANT: 1415 WEST AVENUE, BUFFALO 13, N. Y.

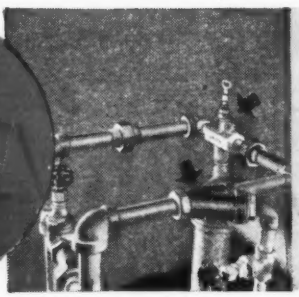
STEAMATHEMATICS

(A NEW DEFINITION OF SARCO SERVICE)



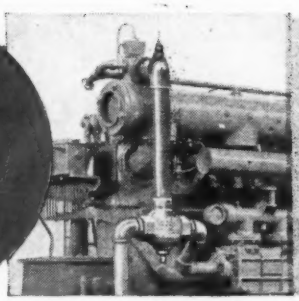
SARCO No. 87 ADDS

The Sarco No. 87 steam trap adds steam in plating tanks, and outdoor tank coils as needed and maintains a constant temperature.



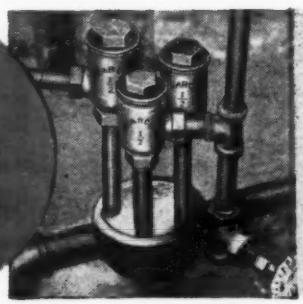
SARCO TR-40 SUBTRACTS

The Sarco TR-40 cooling control reduces temperatures in condensers and engine and compressor jackets by controlled circulation.



SARCO MB BLENDER DIVIDES

The Sarco water blender, a three-way mixing valve, proportions the amount of hot or cold water entering the line for showers, process operations and engine jacket cooling.



SARCO No. 9 MULTIPLIES

Because a trap pushes out the air so steam can follow and because it removes condensate as fast as it forms—it multiplies the effective output—especially when a separate trap is used on each coil.

The Sarco Hook-Up book—hints and kinks from a quarter of a century's experience with calculation data, recommendations and hook-ups for every industry. Free for the asking.

42 42

SARCO COMPANY, INC.
475 FIFTH AVENUE
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Represented in Principal Cities

SARCO Saves Steam

SARCO CANADA, LTD., 85 Richmond Street, West, TORONTO, ONTARIO

THIS →

IS BETTER

PIPING PRACTICE

Than these Together

Why make three welds when two will produce a better piping job? Where it is necessary to change both the direction of flow and size of pipe, the Midwest Reducing Elbow replaces two welding fittings: (1) a standard elbow and (2) a reducer. The many important features are enumerated at the right.

All the advantages of Midwest Standard Elbows are to be found in Midwest Reducing Elbows: unusual dimensional accuracy and uniformity, beneficial effect of working metal in compression, stress relieving, etc. Center-to-end dimensions are the same as in standard elbows with which they are interchangeable.

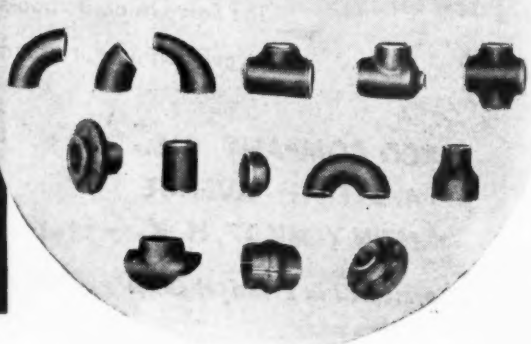
The Reducing Elbow is only one of the many Midwest developments designed to improve the quality of welded piping and to save cost in erection. Write for Bulletin WF-41 for complete information about the advantages of Midwest Welding Fittings.

MIDWEST

REDUCING WELDING ELBOW

Eliminates One Weld
Cuts Installation Costs
Saves Time
Reduces Turbulence
Improves Appearance

MIDWEST
WELDING FITTINGS IMPROVE DESIGN AND REDUCE PIPING COSTS



MIDWEST

PIPING & SUPPLY COMPANY, INC.

Main Office: 1450 South Second St., St. Louis 4, Mo.

Sales Offices: New York 7—(Eastern Division) 30 Church St., Chicago 3—645 Marquette Bldg. • Los Angeles 33—520 Anderson St. • Houston 2—229 Shell Bldg. • Tulsa 3—533 Mayo Bldg. • Atlanta 3—Red Rock Bldg. • South Boston 27—426 First St. • Distributors in Many Cities

HIGH THERMAL RATINGS

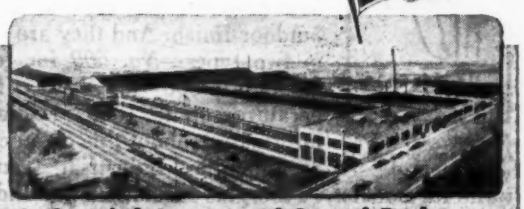
Philadelphia...
WORM GEAR
Speed Reducers

Adequately proportioned housings that permit proper heat radiation have been achieved in the design of Philadelphia Worm Gear Reducers without sacrificing compact construction. This feature is of particular advantage in reducers selected for continuous service where thermal rating must be the determining basis.

Another advantage in Philadelphia design of housings is the rib construction which has been extended and rounded out into a smooth attractive design, stronger, more rigid and more rugged than the conventional, approved design.

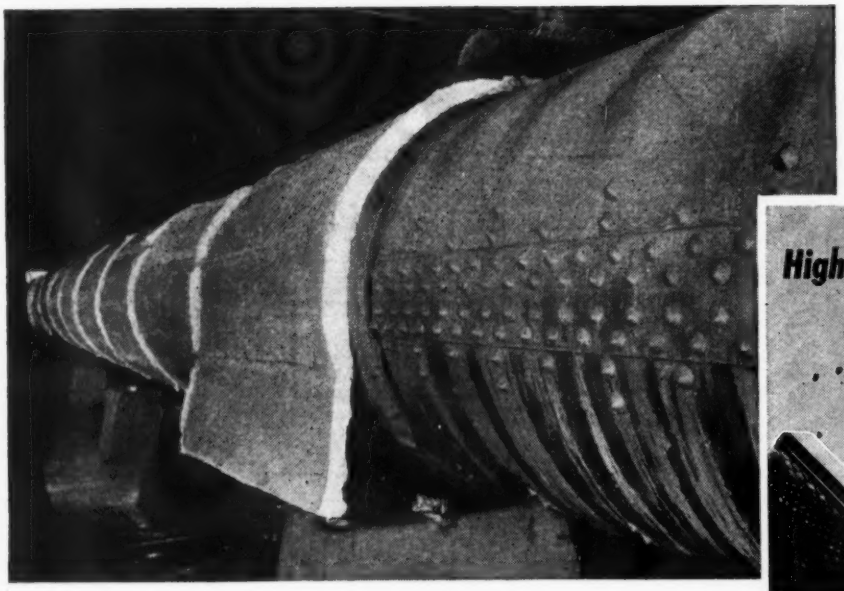
Superior housings are but one of many reasons for selecting Philadelphia Worm Gear Reducers. Philadelphia Worm Gear units are made for vertical and horizontal drive conditions in a full range of horsepowers and reduction ratios. Our Catalog No. 25 will give you full construction details. Write on your business letterhead.

Philadelphia
GEAR WORKS INCORPORATED
AVE. AND G ST., PHILADELPHIA 34, PA. NEW YORK • PITTSBURGH • CHICAGO



Industrial Gears and Speed Reducers
LimiTorque Valve Controls

★retort insulation



. . another job for

FIBERGLAS* METAL MESH BLANKETS

The high thermal efficiency of Fiberglas Insulating Wool is only one of its many advantages as blanket insulation for retorts, boilers, tanks, industrial ovens, large ducts and breechings.

Blankets of Fiberglas Insulating Wool may be had with *mesh facing on one side only!* The fine, long fibers, of which this material is made, interlace to form an insulation that has "body", that holds itself together. This unique and desirable feature is especially advantageous when vessels to be covered have laps, rivets and other projections.

Fiberglas Metal Mesh Blankets are light in weight. They do not disintegrate with handling. Their fluffy edges form a tight seal when the blankets are laced together. And they can be cut to any desired shape to provide a complete seal around valves, pipes and fittings. As a result, they are applied easily, quickly and economically. Many users have enjoyed further savings through re-use.

Fiberglas Metal Mesh Blankets are available with three standard facing materials: hexagonal wire, expanded metal lath and rib lath. These facings provide a suitable base for any type of indoor or outdoor finish. And they are supplied in two types—*No. 600* for temperatures up to 600° F.; *No. 900* for temperatures up to 1000° F. For more information about this or other forms of Fiberglas Industrial Insulations, write for booklet, "Fiberglas Insulations for Industry". *Owens-Corning Fiberglas Corporation, 2000 Nicholas Building, Toledo 1, Ohio. In Canada, Fiberglas Canada Ltd., Oshawa, Ontario.*

In co-operation with the Government program to save critical fuel.

OTHER FIBERGLAS INSULATIONS

1. PF Pipe Insulation—A lightweight, pre-formed pipe covering with high insulating efficiency for temperatures up to 600° F. Made in 3-ft. sections or segments for all standard pipe sizes. Fibrous ends of sections intermesh to form tight joints.

2. Blanket Type Pipe Insulation—With mesh wire on outer side to wrap around pipe and secure with wire through special edging. Manufactured in 2-ft. sections for pipes over 3" O.D. Will withstand temperatures up to 1000° F.

3. No. 600 PF Block—Same materials as in PF Pipe Covering—in blocks 6" x 36" and 12" x 36", standard thicknesses.

4. OC-1800 High Temperature Block—A highly efficient and rugged molded block in sizes 6" x 36" and 12" x 36"—in standard thicknesses. Will withstand surface temperatures up to 1800° F.

5. Insulating Cement—For insulating fittings, valves and all irregular surfaces. Highly efficient . . . withstands temperatures up to 1200° Fahrenheit.

6. OC Mastic—An asphalt emulsion cement for insulated pipe and equipment exposed to outdoor or high moisture conditions.

7. TW - F Wool—Fabricated in bats, rolls and bulk. Used for drying-ovens, heaters, etc., for filling irregular spaces and for fireproofing.

8. PF Board—Manufactured in 5 densities from 2½ to 9 lbs. per cu. ft.—standard sizes 24" x 38", 1" to 4" in thickness. For insulated panels, sound absorption and various structural applications.

9. PF Roof Deck Insulation—9 lb. density with facing to facilitate mopping. Highly efficient, fireproof, rotproof and moisture-resistant board, for application under industrial built-up roofings. Sizes 24" x 48". Thicknesses from 3/16" to 2".

To help you make the proper selection, a "Fuel Savings Calculator" is available for determining heat loss, fuel savings and other factors. Write us for one.

ARMY E NAVY

FIBERGLAS

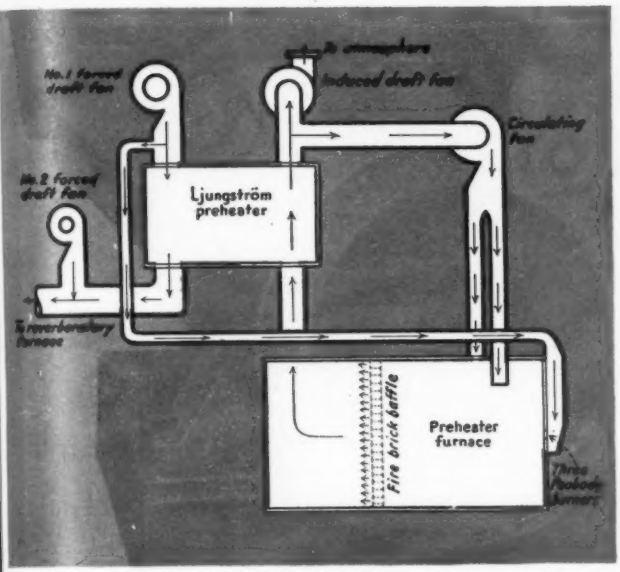
*Trade Mark Reg. U. S. Pat. Off.

INDUSTRIAL INSULATIONS

COPPER SMELTING AT CHINO STEPPED UP BY PREHEAT ENGINEERING

Another NEW APPLICATION FOR LJUNGSTROM AIR PREHEATER

The following excerpts from an article appearing in *Engineering and Mining Journal*, July, 1944, tells our story better than we can.



"Use of preheated air in the reverberatory furnace of a copper smelter burning natural gas or oil as fuel is distinctly a new development, despite the fact it has already found wide application in power generation in steel, cement, lime and numerous industrial plants. The air preheater recently installed at Kennecott's Chino smelter, Hurley, N. M. is perhaps the first of its kind on the American continent . . . The furnace is 32 x 126 feet.

"The results are demonstrating clearly the advantages which may be derived from preheated air. Chief among these advantages is that of improved combustion, resulting in higher over-all efficiency.

"The layout of the air preheater service the reverberatory furnace is shown in the drawing. As will be noted, it consists of a separately fired preheater furnace, and the preheater proper, with fans and control equipment. *The preheater is a Ljungstrom* 19½-V-72 unit, employing the continuous regenerative principle. Its rated capacity is 53,000 C.F.M., the air being received at 60 deg. F, 24.45 in. of mercury, and heated to 926 deg. F.

"In the Chino reverberatory furnace operations, improved combustion has resulted in higher temperatures in the interior of the furnace, consequently bringing about more rapid smelting of the furnace charge."

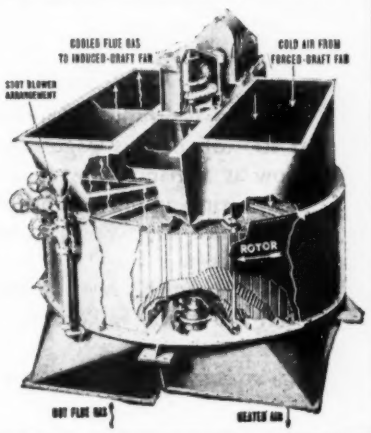
ENGINEERING SERVICE

The engineering staff of the Air Preheater Corporation is prepared to assist you in applying standard or special types of Ljungstrom Preheaters to your fuel conservation needs, or to help you and your engineers make better use of low-grade, more abundant fuels.

THE LJUNGSTROM AIR PREHEATER

The heating surface is contained in a compact, slowly rotating cylinder. Soaking up heat from the hot flue gases, it then rotates to a chamber where it liberates the heat into incoming combustion air.

This continuous, regenerative, counterflow principle assures maximum heat transfer with minimum weight and size. Generally, the Ljungstrom weighs less than half as much as tubular or plate preheaters of similar capacity. With the Ljungstrom, it is possible to obtain preheated air up to 1500 deg. F.

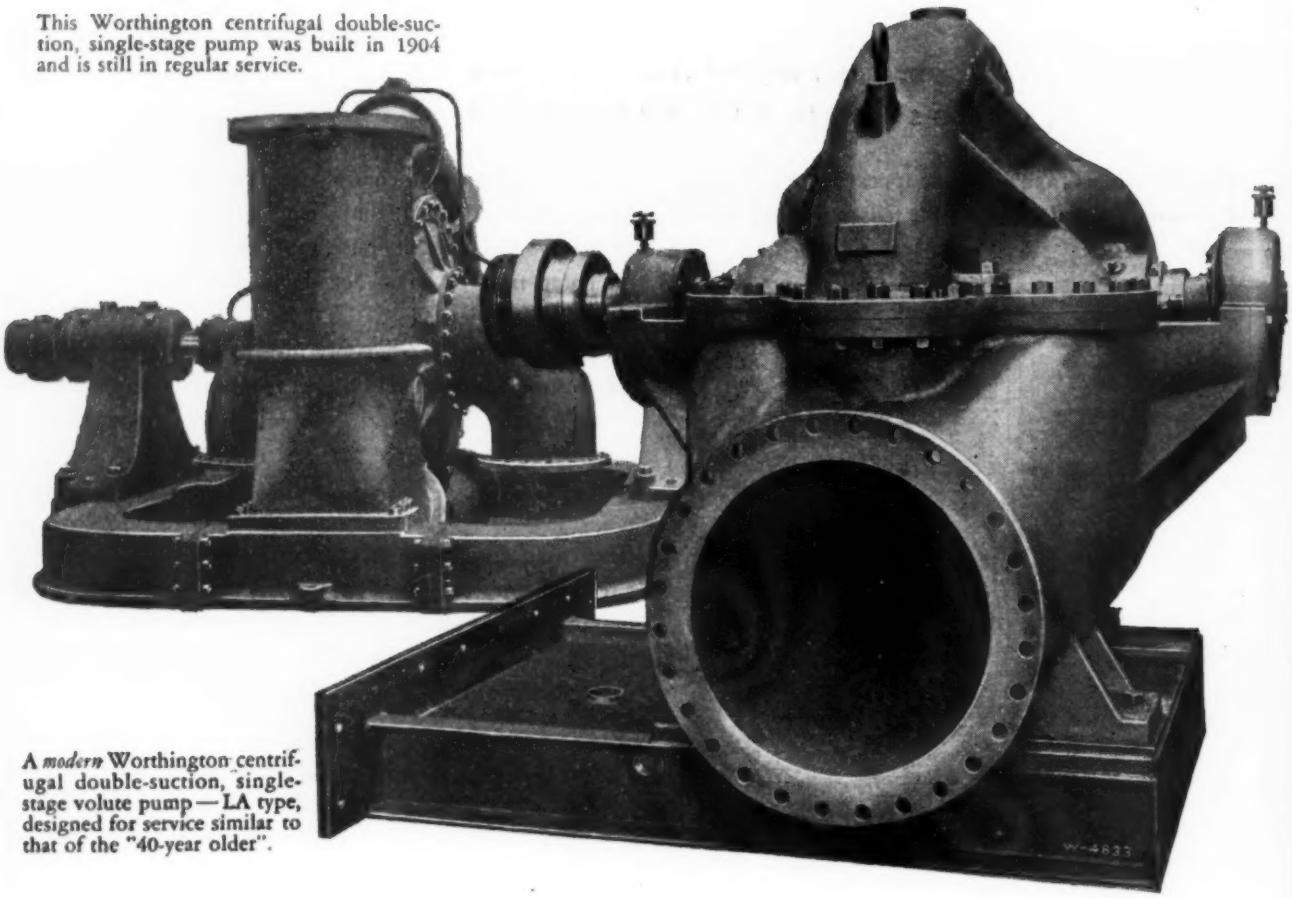


THE
AIR PREHEATER
CORPORATION

Executive Offices: 60 East 42nd Street, New York 17, N. Y. • Plant: Wellsville, N. Y.

IF LIFE BEGINS AT FORTY . . .
ITS BEST YEARS ARE STILL AHEAD

This Worthington centrifugal double-suction, single-stage pump was built in 1904 and is still in regular service.



A *modern* Worthington centrifugal double-suction, single-stage volute pump — LA type, designed for service similar to that of the "40-year older".

. . . *for Worthington Builds Pumps to Last*

The two Worthington centrifugal pumps illustrated at the top of this page offer striking contrasts that show at a glance how far Worthington design and engineering improvements have progressed in the years since the Worthington "40-year older" was built!

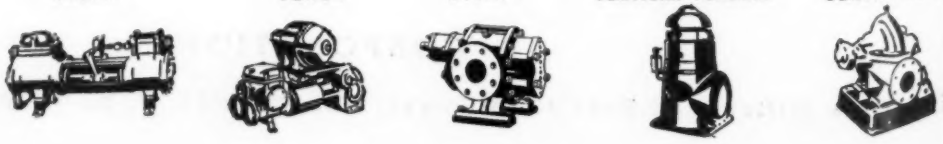
BUT . . . in this one important way there has *never* been any change in Worthington pumps . . . from the oldest to the youngest . . . and that is *the high quality of Worthington design and manufacture.* Old or young . . . large or small . . . *all* Worthington centrifugal pumps provide the utmost in dependability and fitness for service. Write us, or call our nearest district office for specific information. *Worthington Pump and Machinery Corporation, Centrifugal Pump Division, Harrison, N. J.*

WORTH BEHIND THE NAME
WORTHINGTON

CP6-39

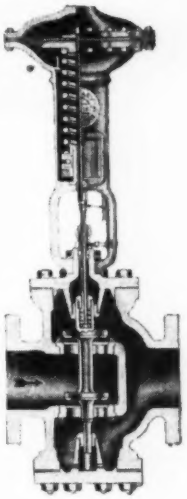
WORLD'S LARGEST MANUFACTURER OF PUMPS

STEAM POWER ROTARY VERTICAL TURBINE CENTRIFUGAL



THE YEAR THE UTES RAISED MERRY NED

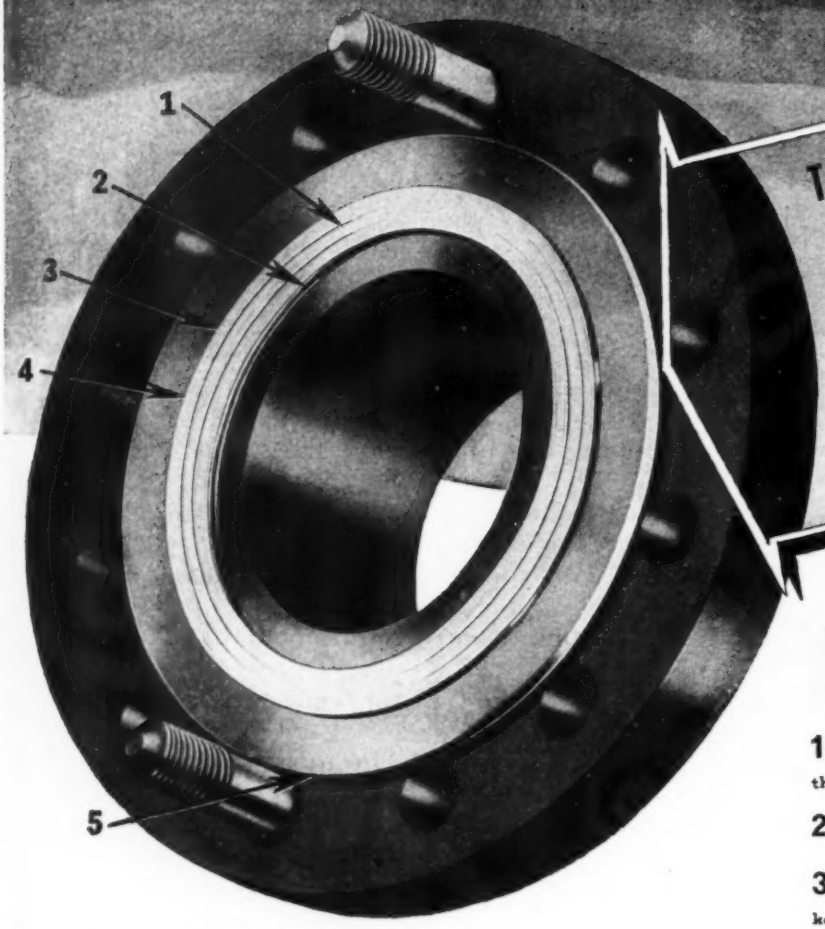
THE INDIAN uprising at White River in the new state of Colorado was unexpected. Hostilities were fierce—but quickly quelled. That was 1879, the same year Kieley & Mueller introduced the steam trap. This too, was unexpected—an entirely new idea—the "daddy" of all traps. Control equipment has come a long way since 1879. Witness the K & M Diaphragm Motor Valve, for supersensitive pressure control of steam, oils, liquids, gas or air. Designed for use with air-operated instruments or auxiliary pilot units—in models to meet every condition of flow, pressure and temperature. Patented special features assure minimum friction lag and maximum efficiency. Type 484 is only one of more than 100 K & M precision control devices which benefit from our 64 years of specialization. Write for general Catalog No. 66.



KIELEY & MUELLER, INC.
MANUFACTURERS OF PRESSURE AND LEVEL CONTROLS SINCE 1879
NORTH BERGEN, NEW JERSEY

FLEXITALLIC C-G GASKETS

for High-Pressure Flanged Joints



THIS RING HELPS YOU MAKE A PERFECT SEAL AND IT SAVES YOU A LOT OF TIME

The solid ring of a Flexitallic C-G gasket does not seal the opening between flanges—the active, sealing member contained within the ring does that. The ring plays its part in two principal ways:

(1) When the joint is being assembled, the ring touches the bolts all around—the outside ring-diameter being of a size in keeping with established marine and A.S.A. standards. Thus the ring sees to it that the sealing member is properly located between the flanges.

(2) Thickness of the ring is less than that of the sealing member. When the flanges are drawn together, they compress the sealing member and continue to do so until the flanges meet the ring. The amount of compression thus achieved is exactly the right amount for a perfect seal.

Perfect seal in least time. Without the aid of the C-G ring, a lot of time can be wasted in making joints—wasted in getting a gasket to its right seat and in pulling up on the bolts.

"Flexitallic" Reg. U.S. Pat. Office

Representatives in Principal Cities

KNOW ALL THE FEATURES OF FLEXITALLIC C-G GASKETS

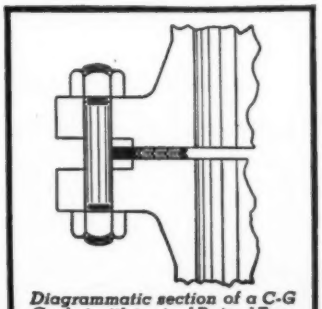
1 Density of the sealing member is modified in manufacture so as to be correct for the specified pressure of the line.

2 I.D. of gasket is clear of orifice at all points, offering no impediment in line.

3 Correct bonding load assured by surrounding solid-metal ring which serves as a thickness gauge for gasket when joint is made up.

4 Fit of surrounding ring, allows inner member to expand under compression.

5 Correct position assured by O.D. of gauge ring which fits inside of bolts.



Diagrammatic section of a C-G Gasket with typical Raised Face fittings showing the flanges compressed to the thickness of the solid metal member.

FLEXITALLIC GASKET CO., 8th and Bailey Streets, Camden, N. J.

Originators of Spiral Wound Construction

How CHASE ANTIMONIAL ADMIRALTY* REDUCES tube replacement costs

In condenser tube alloys for brackish cooling water conditions, Antimony added to Admiralty greatly increases resistance to dezincification. This longer service life you enjoy with Chase Antimonial Admiralty can reduce considerably your condenser tube replacement costs.

It is not uncommon, for example, to find Antimonial Admiralty tubes installed as far back as 1935 still going strong today. Consider the saving here in tube replacements alone. Yet Chase Antimonial Admiralty costs no more than plain Admiralty. Like more of the feature-facts? Just phone the nearest Chase Warehouse or Sales Office for full information.

Points to Remember About Antimonial Admiralty

1. Extraordinarily resistant to dezincification.
2. Virtually immune to stress-free intercrystalline corrosion.
3. Costs no more than plain Admiralty.

Initial cost of tubing with Antimonial Admiralty is no greater than with plain Admiralty—and replacement costs are reduced by longer tube life.

*U. S. Patent No. 2,061,931

CHASE

SPECIAL STOCKS OF ANTIMONIAL ADMIRALTY at HOUSTON LOS ANGELES NEW ORLEANS SAN FRANCISCO TULSA

CHASE BRASS & COPPER CO.

—Incorporated—
Waterbury, Connecticut
SUBSIDIARY OF KENNECOTT COPPER CORPORATION

ALBANY† ATLANTA† BALTIMORE BOSTON CHICAGO CINCINNATI CLEVELAND DETROIT HOUSTON INDIANAPOLIS† KANSAS CITY, MO.† LOS ANGELES MILWAUKEE MINNEAPOLIS NEWARK NEW ORLEANS NEW YORK PHILADELPHIA PITTSBURGH PROVIDENCE ROCHESTER† SAN FRANCISCO SEATTLE ST. LOUIS WASHINGTON†

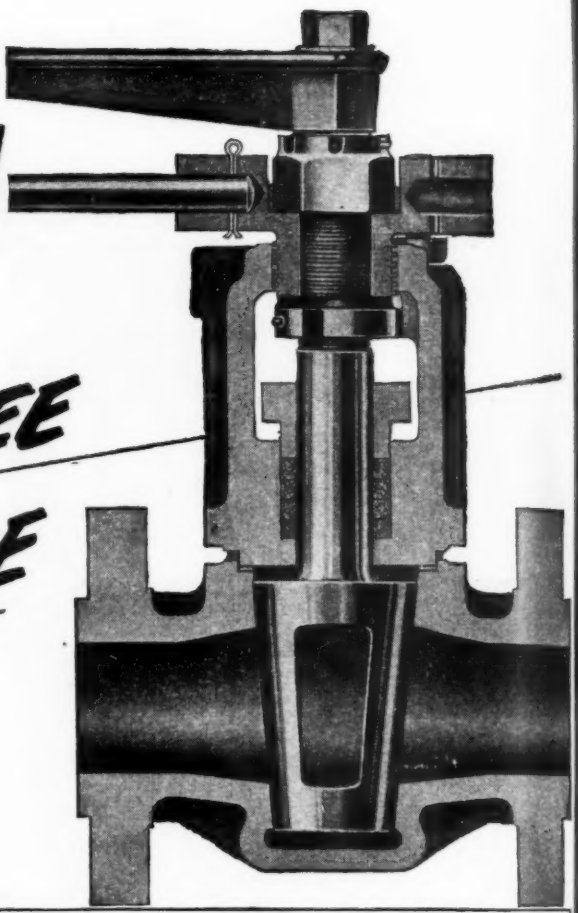
† Indicates Sales Office Only

This is the Chase Network—handiest way to buy brass

6 Reasons Why

Homestead Lever-Seald Valves give

TROUBLE-FREE PERFORMANCE



Hundreds of industrial plants are meeting today's demands for economy of operation and long, unfailing performance, by replacing old, defective valves with TROUBLE-FREE Homestead Lever-Seald Valves, and specifying them for new installations.

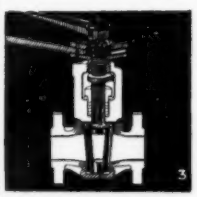
Homestead Lever-Seald Valves are *stick-proof.* They always work! Neither corrosive or viscous fluids nor extremes of temperature or pressure can make them stick. They operate 16 to 28 times faster than screw-stem-type valves because they are fully opened or closed by a *quarter turn.* They *seal without lubricants,* and their *seating surfaces are protected from corrosion or cutting action of fluids,* both when the valve is opened or closed. Their operating parts are fully protected, too, assuring longer service and lower upkeep.

There is a Homestead Lever-Seald Valve in the right metal or alloy to suit your requirements. Write for Valve Reference Book No. 38 for Homestead Lever-Seald Valves in sizes 1½" to 10", for pressure ranges from 150 to 1500 pounds. Consult Homestead engineers on all your valve problems.

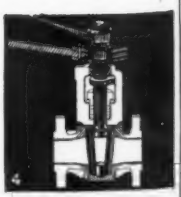
Shaded Valve Parts Show These Advantages:

1. Instant, stick-proof operation assured by powerful leverage

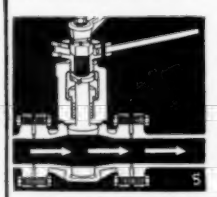
2. Quarter-turn fully opens or closes



3. Positive seal without lubrication



4. Seating surfaces always protected in both open and closed positions. Corrosion practically eliminated



5. Unobstructed straight-line fluid flow —minimum pressure drop

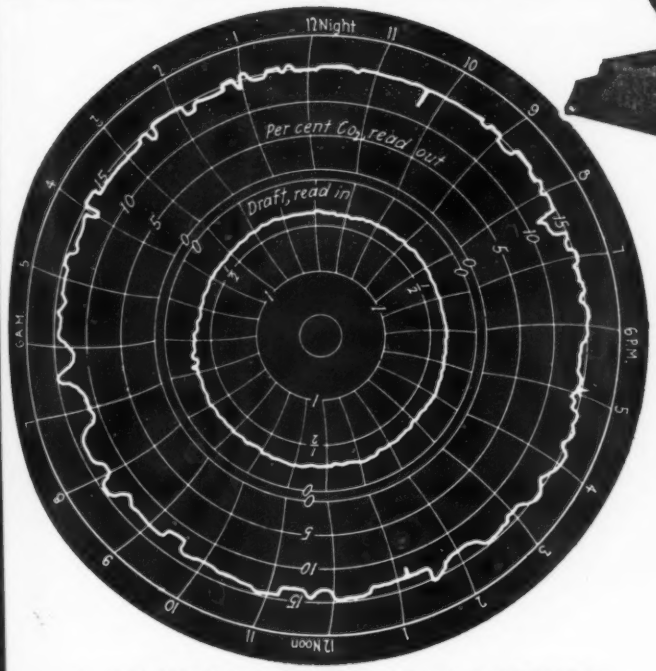
6. All operating parts protected from damaging effects of service conditions and weather.

"M" Pennant with two additional gold stars—Maritime's highest production award to our men and women making valves for the Victory Fleet.

Homestead LEVER-SEALD VALVES

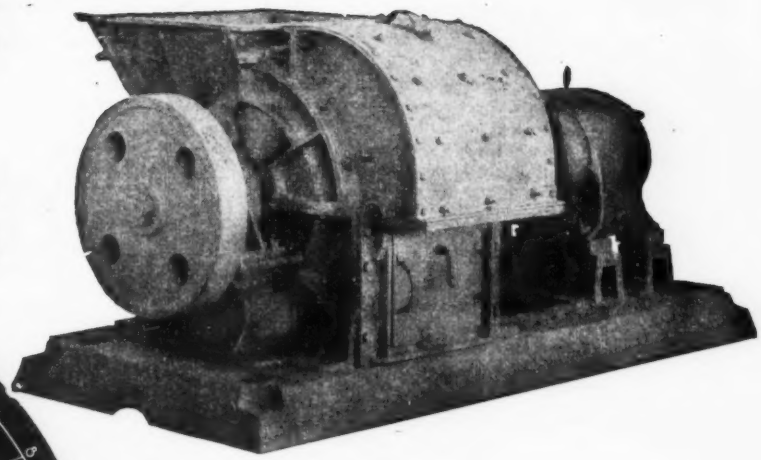
HOMESTEAD VALVE MFG. CO. . . . P. O. BOX 210 . . . CORAOPOLIS, PA.

CO_2 RECORDS SHOW WHAT A DIFFERENCE PROPER COAL SIZING MAKES



1—UNIFORM CO_2 IS ASSURED THE AMERICAN WAY

II—POORLY PREPARED COAL GIVES A POOR CO_2 RECORD



How to step up operating efficiencies from 2½ to 8%

The CO_2 charts shown here disclose the relation that exists between sizing of coal and ashpit loss. Study them carefully and note (Chart I) the greatly increased CO_2 percentage when coal is properly sized as compared with poor sizing (Chart II).

For maximum economy, coal should be of uniform size and that means a GOOD COAL CRUSHER — and the "AMERICAN" has definitely proved that it meets the most exacting specifications for proper coal sizing.

From our experience over the years in the field in conjunction with both large and small plants, we are certain that the installation of a proper coal crusher will result in increasing operating efficiencies from 2½ to 8% and that overall efficiency may be raised 3% through reducing ashpit and excess-air losses.

If you are working toward attaining maximum efficiency in your plant, ask our engineers to study your coal preparation problem and determine whether or not you can improve your method of crushing and sizing coal.

You'll be interested in Bulletin "Crushing Coal at Less Than One Cent per Ton." Write for your copy today.

AMERICAN PULVERIZER COMPANY
1219 Macklind Avenue
St. Louis, 10, Missouri
ORIGINATORS AND MANUFACTURERS OF RING CRUSHERS AND PULVERIZERS

STATOR

Coils are form wound, diamond shaped interchangeable and carefully insulated with selected materials. Core is built of accurately punched mill varnished, motor special, electrical sheet steel.

ROTOR

Rotor is of all welded construction. The core is built of electrical sheet steel punchings having partially closed slots. The winding is made from hard drawn copper strip driven into the slots. The ends of the rotor bars are welded to copper or alloy end rings. These rotor bars also provide fan action for efficient ventilation.

LIFTING LOOP

All sizes have large lifting loop to accommodate crane hook for easy handling.

BRACKET & BEARING

Bracket is cast iron, simple design, providing rugged bearing support with ample lubrication and a minimum of parts and machined fits.

VENTILATION

Cooling air, circulated by rotor bar fan is taken in through bracket openings and discharged at the center frame opening.

FRAME

Constructed of rolled steel rings with heavy cross ribs, angle type web feet and electrically welded.

SHAFTS

Shafts are large and well proportioned of 30-40 carbon steel.

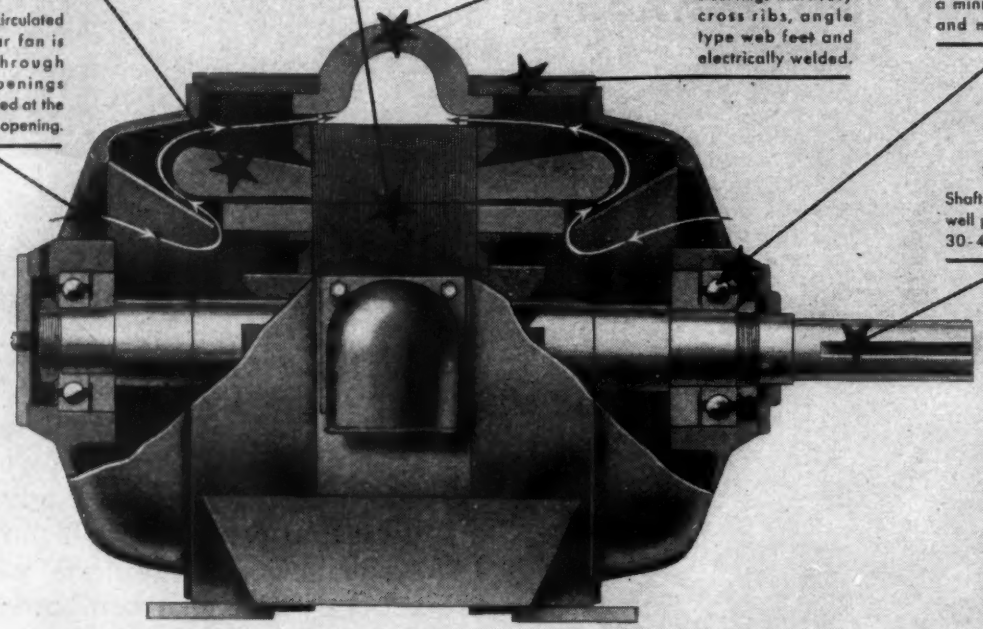
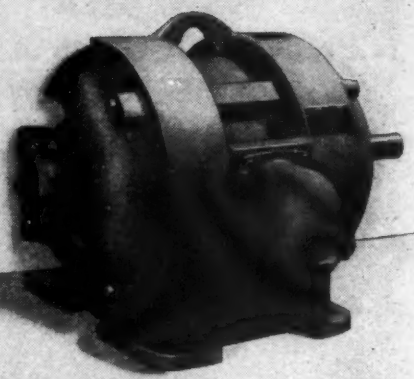


Illustration shows cross section view of Burke Type N 50 h. p. Induction Motor

BURKE *Induction* MOTORS *1 to 1500 h. p.*



BURKE is a quality motor builder producing a standard line of motors but also able to meet exacting specifications of special applications. Burke Induction Motors are built in sizes from 1 to 1500 h. p. in all types, open and enclosed, both squirrel cage and wound rotor. Let Burke build for you. Send your specifications to Burke engineers today. Write for Bulletin 101 describing Burke Induction Motors.

SYNCHRONOUS MOTORS AND GENERATORS | **INDUCTION MOTORS** | **D. C. MOTORS** | **D. C. GENERATORS** | **M. G. SETS** | **HIGH SPEED A. C. GENERATORS**

MOTORS 1 TO 1500 H. P. • GENERATORS 1 TO 1000 K. W.

BURKE A.C. & D.C. Motors & Generators

BURKE ELECTRIC COMPANY, ERIE, PENNSYLVANIA • Since 1891

Photo, courtesy I. T. E. Circuit Breaker Co.

Here's a mounting material that *can take it!*

K&M EBONIZED ASBESTOS

• K&M Ebonized Asbestos panelling is designed for modern requirements. It is made of a combination of asbestos fibre, binding cement, insulating compound . . . all in proper proportions . . . and molded under great pressure into strong monolithic sheets. Here are some of the outstanding features of this durable electrical insulation!

Exceptionally high dielectric strength.
Uniform density throughout.
Withstands severe shock, vibration and wide temperature variations.
Resists oil and water action.
Does not shrink, crack or bulge.

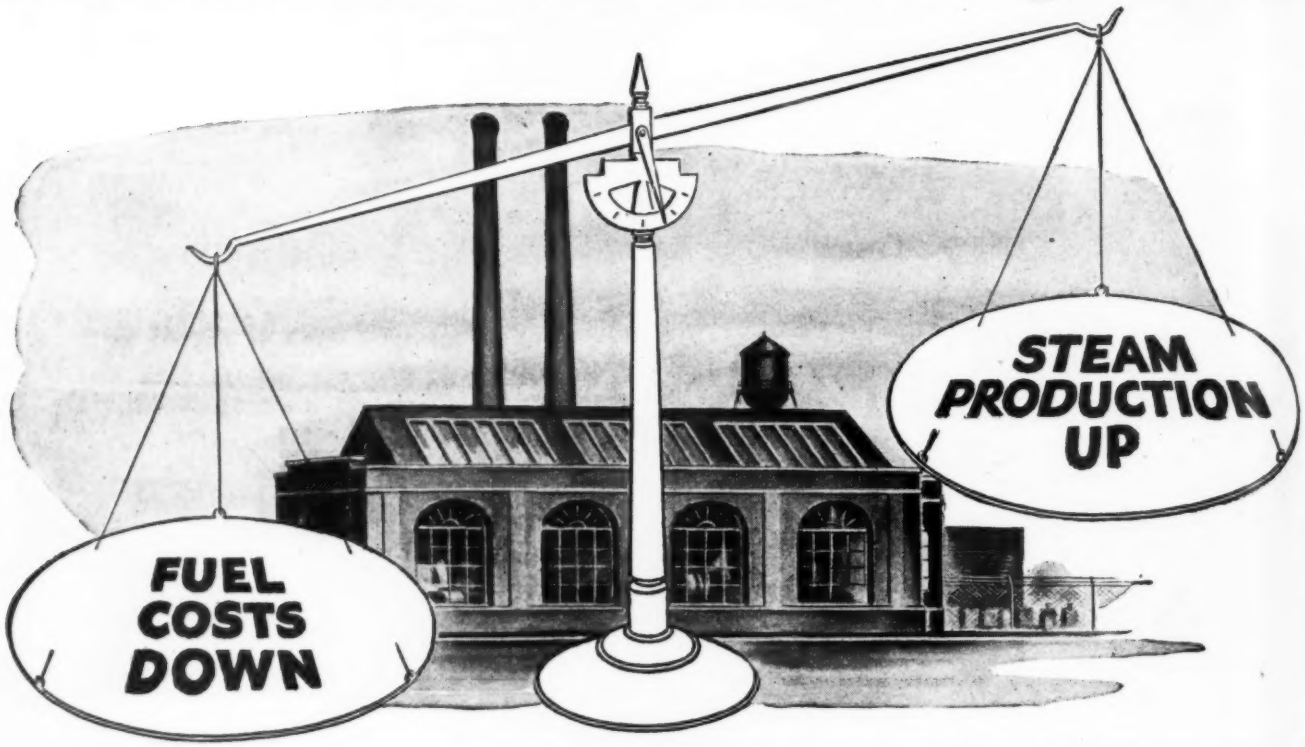
Use K&M Ebonized Asbestos for switchboards, bus bar runs, testing tables, cabinets, bench boards, compartment linings . . . and many other types of electrical installations.

Thanks to expanded facilities, K&M Ebonized Asbestos is now available for immediate delivery . . . in thicknesses from 1/8" to 4 inches, standard or special "panel" finish. This material is specially developed to meet the technical requirements of the Underwriters Laboratories, Inc., when built into an assembled unit.

Our Ambler plants proudly fly the Army-Navy "E" flag with its star—an honor awarded K&M employees "for continued outstanding production of war materials."

KEASBEY & MATTISON COMPANY, AMBLER, PENNSYLVANIA

For a well balanced boiler plant...



modernize NOW with TODD!

DOES your present oil burning equipment carry its full share of the plant's heat and power load?

Does inefficient combustion throw your steam system "off balance" . . . reducing steam production below the possible capacity of your boilers?

Todd combustion engineers give special attention to this problem of *balance* in the boiler room—specifying burner equipment designed for the job—in your particular plant—firing your particular boilers.

Hundreds of industrial and commercial plants have already modernized costly, inefficient steam systems by installing Todd oil or gas burning equipment. Actual records show greatly increased boiler capacity and fuel savings ranging up to 10% and more.

Besides helping to deliver peak wartime power requirements, Todd burners will put your plant in a better competitive position for the years ahead. Another good reason why NOW IS THE TIME TO MODERNIZE WITH TODD!

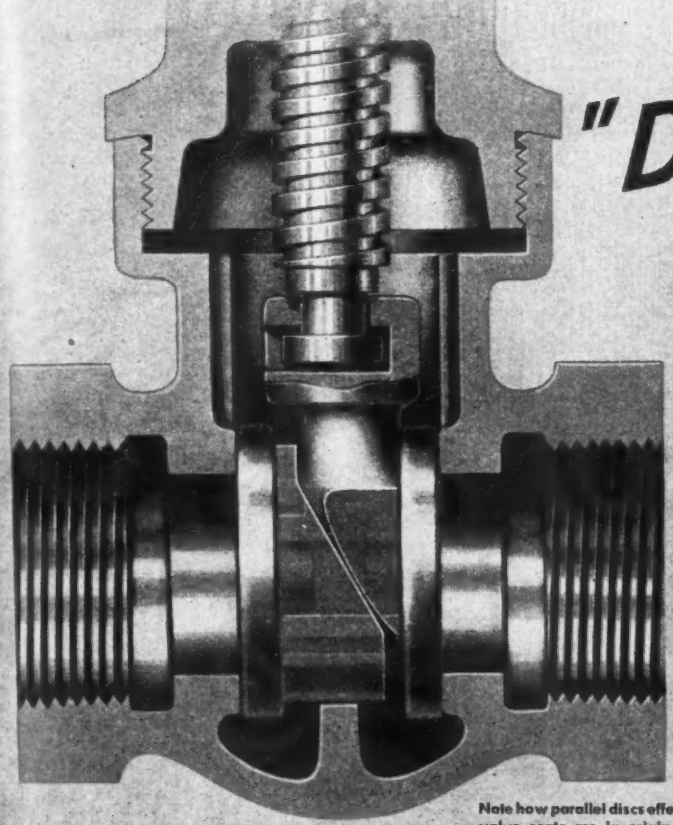
ARMY E NAVY

COMBUSTION EQUIPMENT DIVISION
TODD SHIPYARDS CORPORATION
601 West 26th Street, New York 1, N. Y.

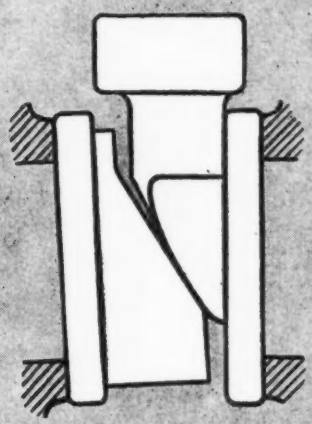
NEW YORK, BROOKLYN, ROCHESTER, HOBOKEN, NEWARK, BARBER, N. J., PHILADELPHIA, SO. PORTLAND, ME., BOSTON, SPRINGFIELD, MASS., BALTIMORE, WASHINGTON, CHICAGO, GRAND RAPIDS, TAMPA, GALVESTON, HOUSTON, MOBILE, NEW ORLEANS, LOS ANGELES, SAN FRANCISCO, SEATTLE, TACOMA, MONTREAL, TORONTO, BUENOS AIRES, LONDON

ON THE FIRING LINE OF AMERICA'S WAR PRODUCTION FRONT

DARLING...the valve that can give you "DROP-TIGHT" SEATING...

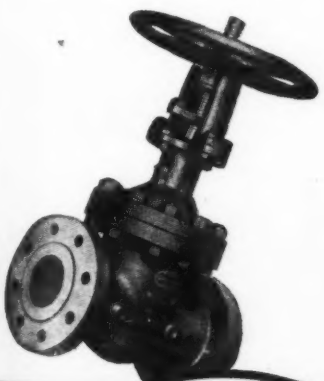


Note how parallel discs effect tight closure when valve seats are in original parallel position.



This greatly exaggerated diagram shows how the curved face of the upper wedge allows the discs to fit against seats, "unparalleled" by valve body distortion.

Darling manufactures a quality line of gate valves for long service—in parallel seat or tapered seat—slotted or solid wedge types—for service pressures up to 3000 pounds. Valves are available in cast iron, bronze, cast steel, forged steel, corrosion resisting and special alloys. Darling also manufactures check valves, compression type fire hydrants, motor and cylinder operated valves, and accessories.



THERE is one gate valve design that insures "drop-tight" seating, year after year. It is the unique Darling design. Darling's fully revolving double disc parallel seat gate valve provides:

1. ADAPTABILITY—Any valve can close tight the day before it is installed. But the day after is another story. Pipe out of alignment and bolting strains distort valve bodies. Pressure and temperature changes and other operating strains force valve bodies out of shape, too, so that gate and seats do not remain parallel.

To compensate for "unparalleled" seats, in the Darling valve wedging assembly a straight or tangent surface on the lower wedge acts on a curved or "radius" surface on the upper wedge. So no matter what position valve seats reach in years of usage, the Darling twin discs make perfect closures.

2. UNIFORM WEAR—The twin discs are free to revolve 360°, seating in a different position each time the valve is operated. Wear on discs and seats is uniform, making possible tight closing year after year.

3. INSTANT RELEASE—The four simple parts of the valve assembly—two discs, two wedges—release at the first fractional turn of the stem to open. The gate is immediately free to rise with little or no friction.

For over 40 years engineers have found that Darling Valves give "drop-tight" shut-off, long life and low maintenance.

NOW—when maximum uninterrupted production is all-important—you can safeguard it by installing Darling Valves. Later, when low-cost operation and maintenance are vital, you will be all set with valves that help you keep costs down and help you compete in postwar markets.

TRADE DARLING MARK

DARLING VALVE & MANUFACTURING CO.
WILLIAMSPORT, PA.

"CATHEDRAL of FLAME"

THIS is the fire chamber of a giant boiler — a veritable cathedral of flame. Its vaulted interior extends beyond the height of an eight-story building. Along its walls and ceiling are more than 12 miles of Globe Steel Tubes — steam lines that produce driving power for huge turbo-generators. Globe boiler tubes successfully stand up against the intense heat and high pressures created by this steam generating operation.

Our engineering staff plus excellent laboratory facilities and production capacity, recommends, tests and produces the right tube for your most exacting requirement. Always specify Globe steel tubes. Send for Bulletin 103A which contains interesting technical data on Globe Tubes.

1103

★ STAINLESS TUBES
★ BOILER TUBES
★ GLOBEIRON TUBING
★ GLOWELD TUBES

GLOBE TUBES

★ CONDENSER AND HEAT EXCHANGER TUBES
★ MECHANICAL TUBING

GLOBE STEEL *Tubes*

GLOBE STEEL TUBES CO., *Milwaukee 4, Wis., U. S. A.*

16 YEARS SERVICE—87.5% EFFICIENCY

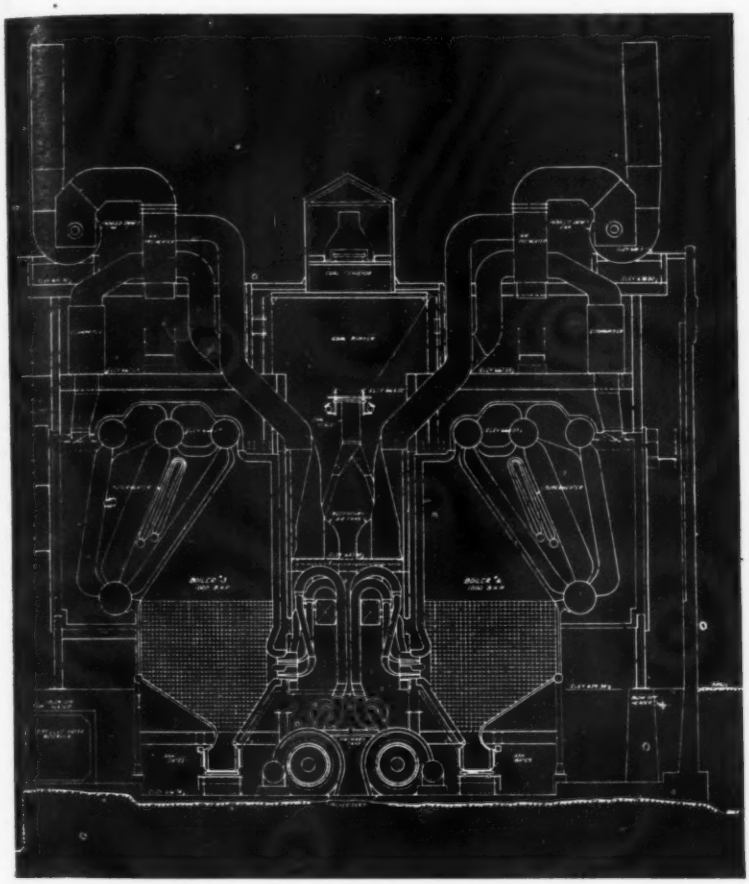
and a

REPEAT ORDER

for

KENNEDY

AIR SWEPT TUBE MILLS



These KENNEDY AIR SWEPT TUBE MILLS produce a continuous fineness of 93.0% through 200 mesh, and 70% through 325 mesh on Strip Mine Illinois Coal. These mills have maintained 85% through 200 mesh with coal having 12% moisture.

Power consumption is 14.1 KW per ton of coal pulverized. Maintenance on KENNEDY AIR SWEPT TUBE MILLS has averaged $0.0122 per ton over a period of 16 years continuous service. Average monthly boiler efficiency 87.5%.

This installation—made sixteen years ago in a large mid-western central power station—includes 3-1000 H.P. boilers, equipped with superheaters, economizers and air-preheaters. Each boiler is fired with 2-KENNEDY AIR SWEPT TUBE MILLS, 5 ft. diameter by 9 ft. long.

TWO MORE KENNEDY MILLS

Based on this performance, (2) 8' x 13' KENNEDY AIR SWEPT TUBE MILLS were selected for coal preparation in this plant with the addition of a boiler of 450,000 lbs. per hour, 1200 lbs. pressure and 900° temperature. This installation has now been in operation for approximately 18 month.

Complete Engineering Service

KENNEDY-VAN SAUN offers a complete steam power plant service under one responsibility, which includes supplying complete steam generating units, pulverizing equipment, burners, fans, coal elevators, bunkers, coal weighing scales, ash conveyors and necessary equipment. Ask for complete details.

Write for Bulletin 12

Let our engineers help you with your special problems of burning lower grade coal to meet your production requirements.

Kennedy-Van Saun

MANUFACTURING AND ENGINEERING CORPORATION

2 PARK AVE., NEW YORK 16, N. Y.

Factories: Danville, Pa., Canada, England, Australia

THIS BOOK TELLS YOU HOW TO DO IT—MAIL COUPON

Kennedy-Van Saun Mfg. & Engr. Corp., 2 Park Ave., New York 16, N. Y.

Kindly send me Bulletin No. 12 explaining how lower grade coals can be burned efficiently.

Name.....Position.....

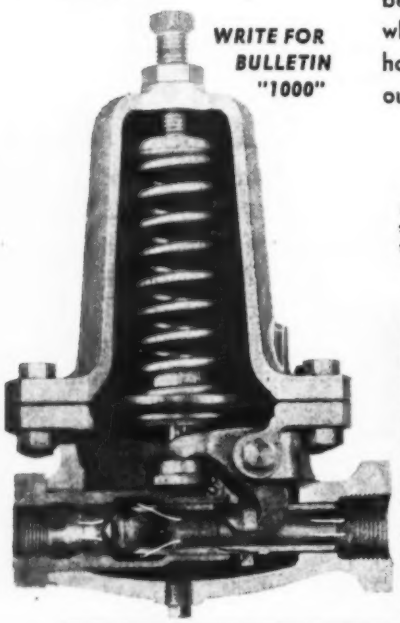
Company.....

Address.....P-11-44

CASH STANDARD Streamlined PRESSURE REDUCING VALVE TYPE 1000

OUR CLAIMS

1. Maximum Capacity when needed most
2. Accurate Pressure Control under toughest working conditions
3. Trouble-free Service
4. Smooth Operation
5. Tight Closure
6. Accurate Regulation
7. Speedier Production Results
8. Elimination of failures
9. Constant Delivery Pressure
0. Cost Saving Operation
1. No Spoilage
2. Practically zero in maintenance costs



WRITE FOR BULLETIN "1000"

USER CONFIRMATION

"We could not afford to have pressure build up because of low pressure equipment. When we started to use the '1000' our troubles stopped."

"One of our plants needed a good valve for close control on fuel oil. This valve has given fine service and has never been touched for any reason."

"We use the '1000' because of the lack of attention needed to keep it operating in first class shape."

"I wanted a valve that would give close control on delicate work in our seed laboratory. Holding air pressure on this spot was not so easy. Needless to say our experience with the '1000' valve has been 100%."

"These '1000' valves don't let the pressure go all over the map but hold the pressure constant."

"The Streamlined '1000' valve has been in for a number of years and to our way of thinking, it's doing what a valve is supposed to do. The fact that we haven't had any trouble with this regulator brings to our mind that it is worth all we paid for it."

How Streamline Design Works

● Flow has been streamlined for straight flow into the delivery passage and jet. See FIG. 1. The fluid flows smoothly around this valve with no back eddies to cause turbulence. See FIG. 2, on the downstream side of its trailing edge. In a reducing valve all the pressure drop or work of pressure reduction should occur at one place, namely where the valve throttles flow, and not on the downstream side of the valve. Where you have downstream turbulence, See FIG. 2, the greatest amount of turbulence with resultant greatest pressure drop will occur when you want maximum flow and therefore want least pressure drop—if the delivery pressure is to be maintained. With Streamlined Flow, See FIG. 1, you get maximum capacity, plus close delivery pressure control.

FIG.- 1

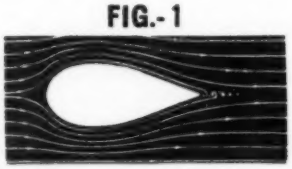
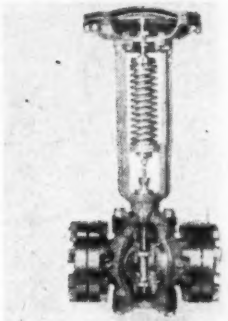
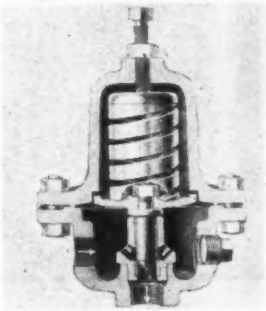


FIG.- 2

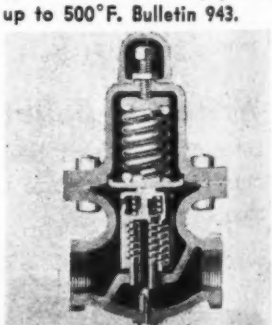
OTHER VALVES *from the* CASH STANDARD LINE



Cash Standard Type 33 Relief Valve; in various metals to handle nearly all fluids. Has Roller guides on valve spindle; also roller bearing to take care of spring torsion. Sizes ½" to 3" screwed ends; 1" to 12" flanged ends. Bulletin 971.



Cash Standard Type Q Relief Valve has side inlet, bottom outlet. Popular for pump bypass use. Sizes ½" to 2" screwed ends. Relief pressures up to 350 lbs., temperatures up to 500°F. Bulletin 943.



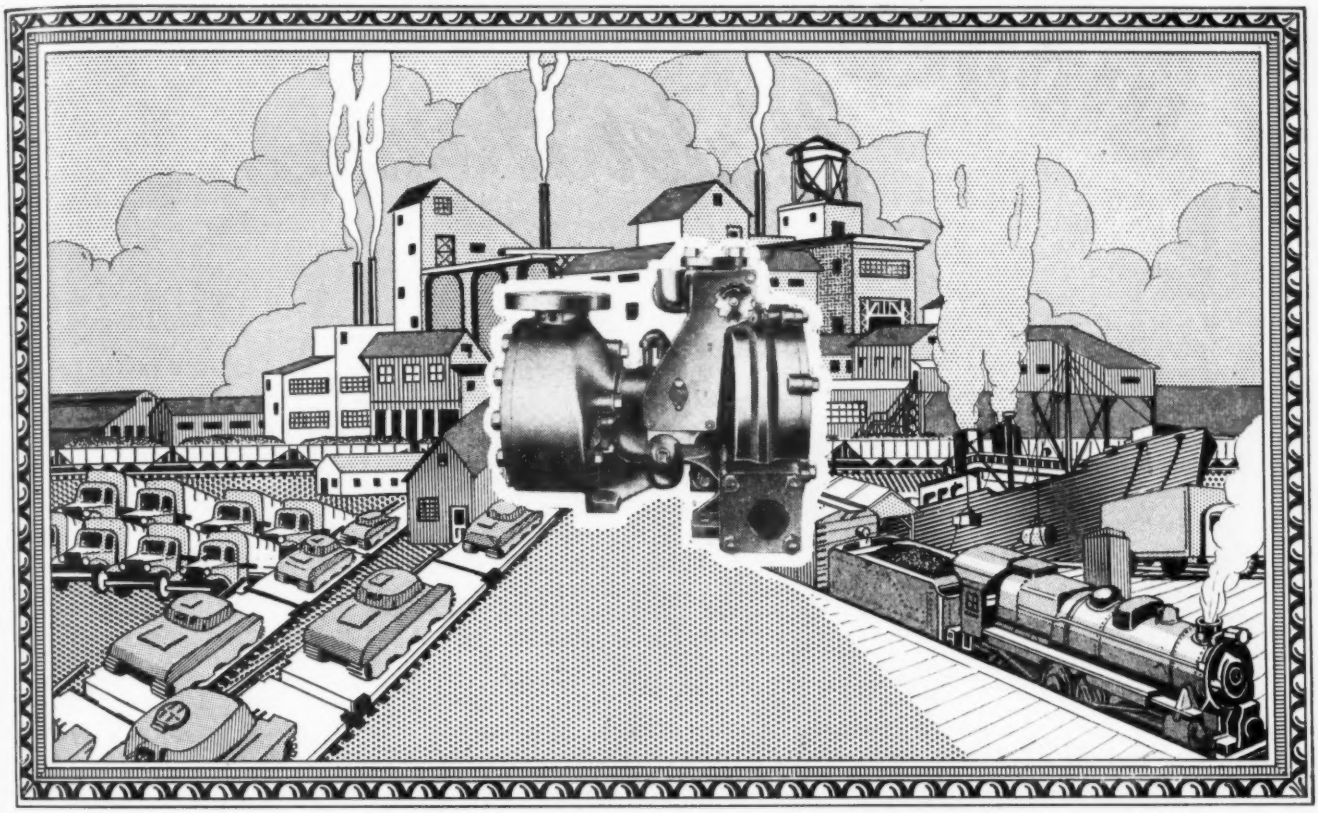
Cash Standard Type 4190 Valve for relief (bypass) use; holds constant valve inlet pressure regardless of changes in load or outlet pressure. Multiport—large capacity. Iron or bronze bodies; iron or bronze trim. Sizes ½" to 2" screwed ends; 2" to 6" flanged ends. Bulletin 952.

☆

CASH STANDARD CONTROLS.. VALVES

A. W. CASH COMPANY
DECATUR, ILLINOIS

The COFFIN—Steam Turbine CENTRIFUGAL PUMP



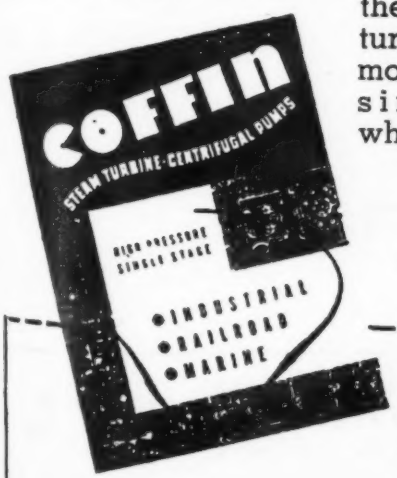
HAS A PLACE IN YOUR CONVERSION PICTURE
JUST AS IT HAS IN YOUR WAR EFFORT

A COFFIN TURBO PUMP purchased now to help your war production can be converted internally, over a wide range, to meet your peace-time requirements. Only a few parts are involved in the change.

Coffin design makes this possible. Both the pump and turbine units are mounted on a single shaft which is housed in an integral cast steel housing.

This provides for numerous pump Impeller and turbine Steam Nozzle combinations to meet exacting conditions. It denotes a long service life with capacity and steam conditions balanced for peak efficiency and economy.

Save space, weight and steam now, and in the Post-War years ahead. Make your next pump a Coffin Steam Turbine Centrifugal Pump.



Mail the Coupon

THE J. S. COFFIN, JR., COMPANY
ENGLEWOOD, NEW JERSEY

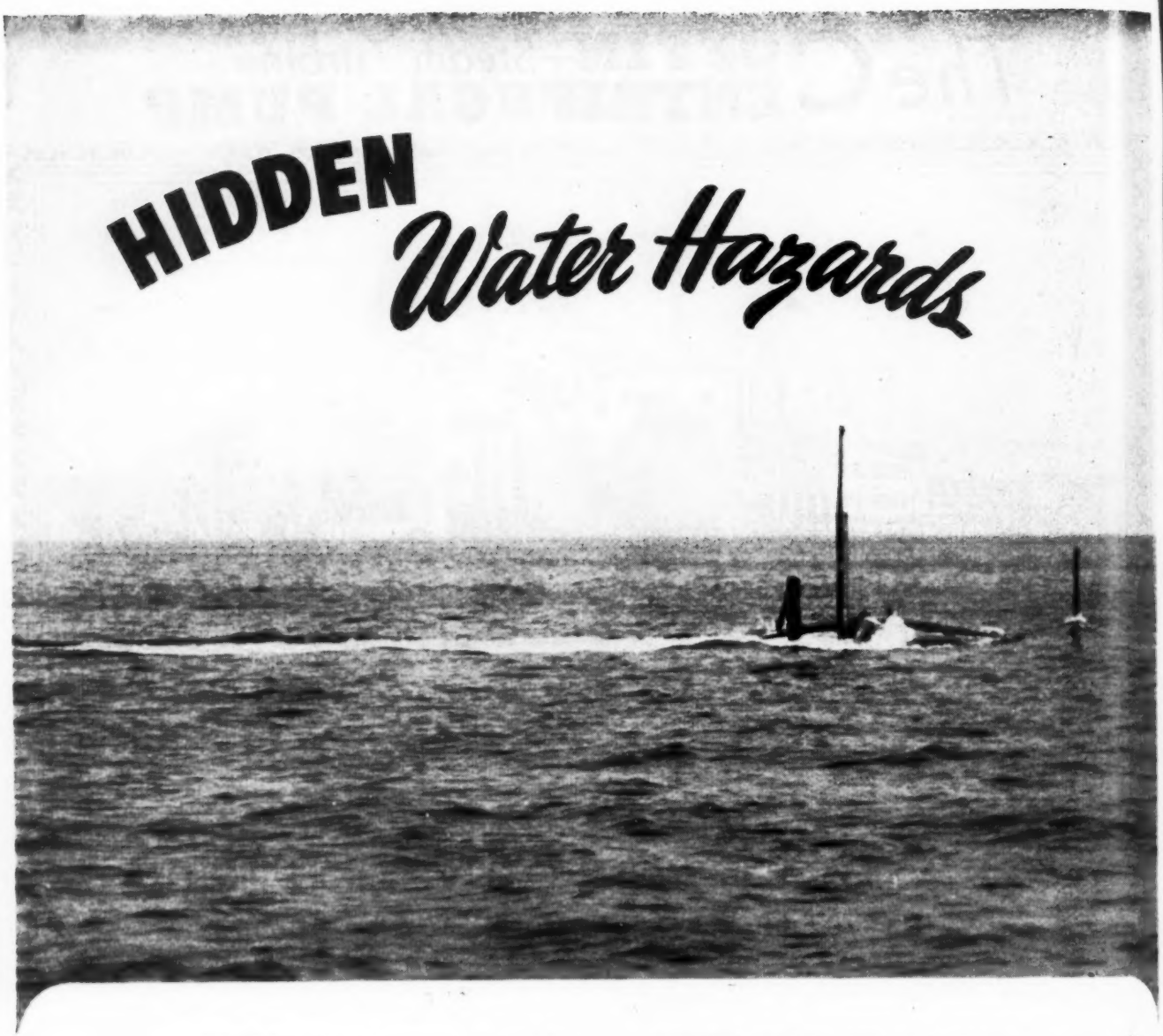
Please Send Descriptive Bulletin I-22

NAME _____

COMPANY _____

ADDRESS
P.W.

HIDDEN *Water Hazards*



● Hidden Hazards . . . sponsored by Uncle Sam . . . are showing up in many waters with devastating results for the enemy.

Hidden Hazards . . . sponsored by Objectionable Dissolved Minerals or Chemical Instability . . . are showing up in many water supplies with just as devastating results for plant equipment and manufacturing processes.

In the latter case action is far from spectacular . . . that's why the Hazards are Hidden . . . but, in either case . . . the end results are the same.

Water that is conditioned to remove objectionable minerals, hardness, corrosion, oil, suspended matter, etc. will protect your production schedules, safeguard irreplaceable power plant equipment, save precious fuel and reduce labor costs.

The power plant, so vital to the war effort, can have the protection of Infilco equipment for boiler or evaporator feedwater treatment, cooling water conditioning, condensate oil removal, steam purification, etc. . . . as well as Infilco chemical feeders and trade waste treating equipment. You are invited to make use of Infilco's 49 years' experience in these allied fields. Call on our Engineering Staff. There is no obligation.

INFILCO

INCORPORATED

325 W. 25TH PLACE, CHICAGO 16, ILL.

INFILCO

ACCELATOR SOFTENERS • CHEMICAL FEEDERS • PROPORTIONERS
WATER FILTERS • CLARIFIERS • COOLING WATER CONDITIONERS
CONDENSATE FILTERS • STEAM PURIFIERS • HOT-FLOW SOFTENERS
LIME-SODA SOFTENERS • ZEOLITE SOFTENERS • CATEXERS

ARMY E NAVY

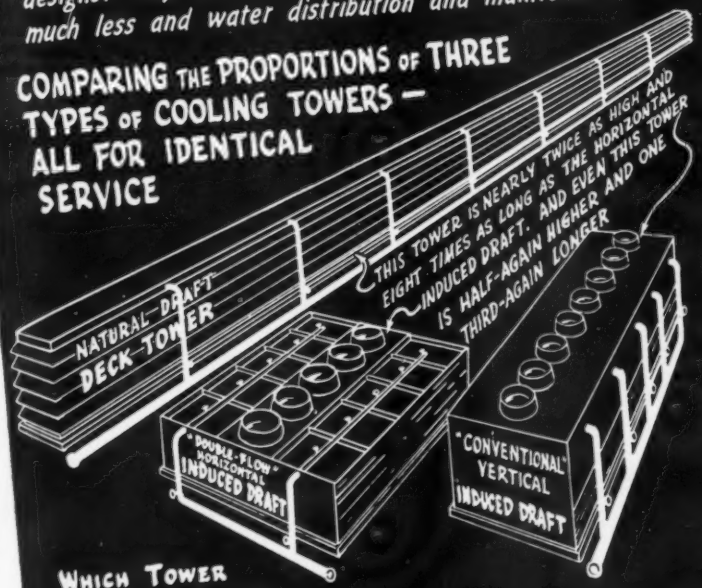
Cooling Tower DOs and DON'Ts

-by MARLEY (No. 5 of a series)

POINTERS ON CONSTRUCTION

In purchasing or evaluating any cooling tower these particulars of construction deserve attention:

GENERAL DESIGN—Towers of broad-and-low proportions are preferable over high-long-narrow designs. They can be better braced, their requirements for pumping, foundation and basin are much less and water distribution and maintenance are simplified.


COMPARING THE PROPORTIONS OF THREE TYPES OF COOLING TOWERS — ALL FOR IDENTICAL SERVICE
NATURAL DRAFT DECK TOWER
THIS TOWER IS NEARLY TWICE AS HIGH AND EIGHT TIMES AS LONG AS THE HORIZONTAL INDUCED DRAFT. AND EVEN THIS TOWER IS HALF-AGAIN HIGHER AND ONE THIRD-AGAIN LONGER
"DOUBLE-FLOW" HORIZONTAL INDUCED DRAFT
"CONVENTIONAL" VERTICAL INDUCED DRAFT

WHICH TOWER IS THE SOUNDEST STRUCTURE, LEAST VULNERABLE TO WIND OR QUAKE? WHICH REQUIRES THE LEAST PIPING AND PUMPING? WHICH CAN BE MOST CONVENIENTLY LOCATED AT MOST PLANTS?

REDWOOD vs. STEEL—Redwood is the principal structural material in all but a small fraction of the total cooling tower capacity installed today. In towers of more than a few hundred GPM, steel is rarely to be preferred. Steel costs more, its service life is not as long, general maintenance greater. It requires frequent and liberal painting with aluminum-base paint inside and out to retard corrosion, whereas Redwood's natural preservatives render painting unnecessary. However if a Redwood tower is painted (for color harmony or to carry an advertising sign) it requires only standard paint, only infrequently, and only on the outside. Fire and safety ordinances which once banned any wood structures on roofs in business areas of some cities now have been modified widely in the case of Redwood due to its proven resistance to burning, its retention of strength in defiance of age and weather, its freedom from all forms of organic attack.

FRAMING—Equally as important as proper size, quality and quantity of members is that connections be sound, snug-fitting, full-bearing, with proven timber connectors (such as "Teco" rings) at critical joints; and footings, angle-washers and other structural hardware as required. Unit working stresses and other values should conform to recommendations of the U. S. Forest Products Handbook. Bolts should be used throughout, with no dependence on nails and no credit for structural strength given to the casing or other non-frame parts.

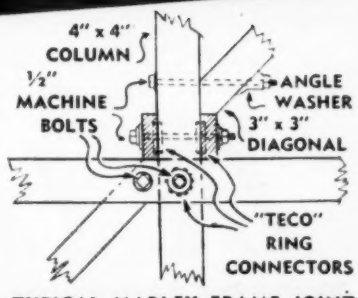
CASING—Walls should be double, with air space between, or otherwise provide for internal drainage of water on the inner surfaces to avoid seepage and unsightly exterior staining. Casing should be applied in a manner to permit necessary expansion and contraction without stress to frame or casing, and to present a smooth, neat exterior.

SAFETY & CONVENIENCE—Adequate stairs, ladders, walks, doors, guards and railings should be provided for safe and convenient access to all parts of tower requiring inspection and service.

MARLEY COOLING TOWERS

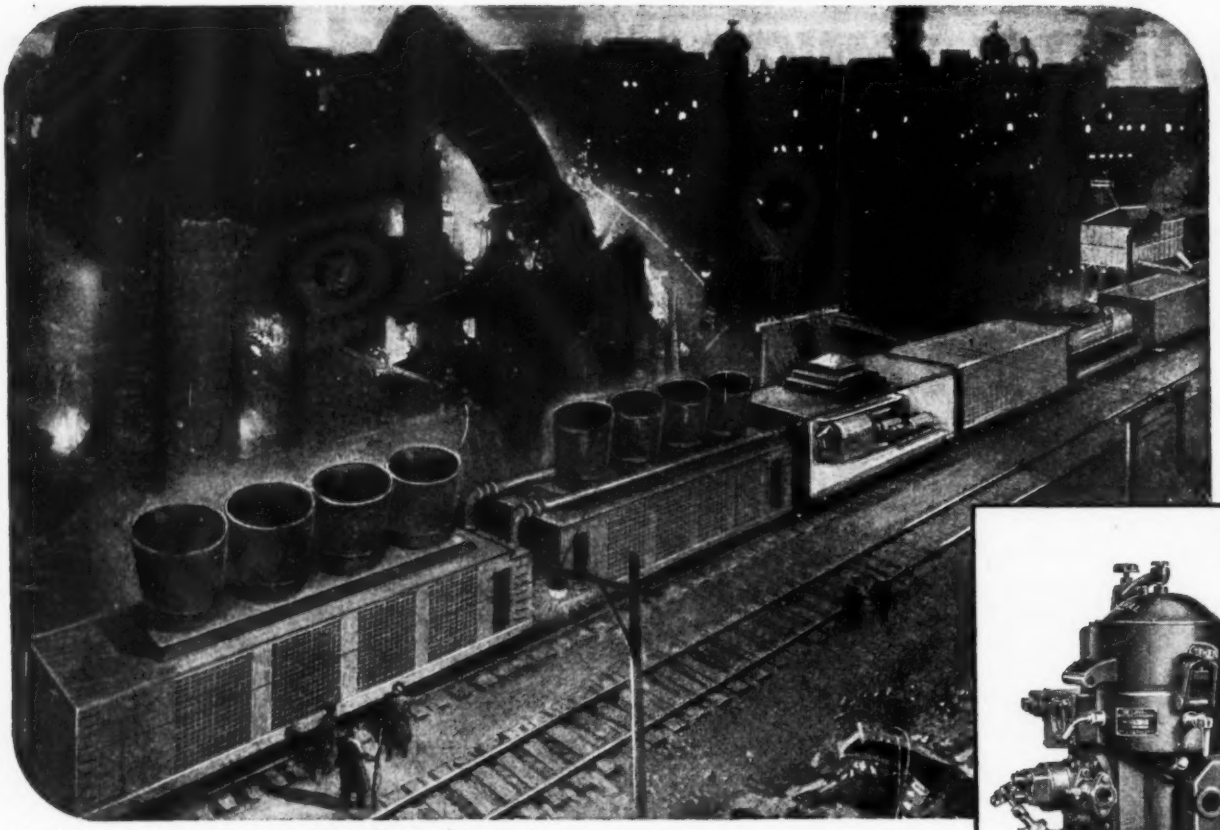
94 A

DO YOU KNOW — snug fit, full bearings, uniform workmanship and sound materials are assured in all frame members and other Redwood parts of Marley towers by 100% *pre-fabrication* in Marley's two large wood-working plants (Stockton, Calif., and Kansas City, Kans.) thoroughly equipped for this exacting service. Marley's structural superiority is a recognized fact, zealously maintained.

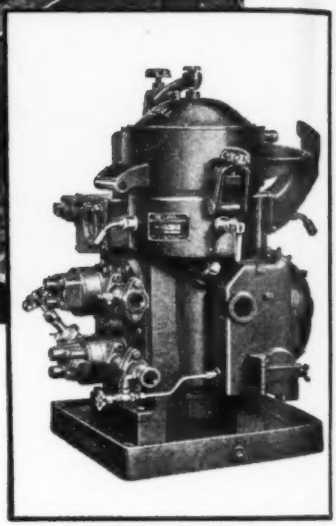


TYPICAL MARLEY FRAME JOINT

THE MARLEY COMPANY, INC. · KANSAS CITY · KANSAS



* *Drawing courtesy Westinghouse Electric & Manufacturing Company*



DE LAVAL Oil Purifiers

PROTECT TURBINES on POWER TRAIN

MOVING swiftly into a village ravaged by war, this Westinghouse Power Train quickly provides all the equipment of a full size power plant of 5000 kilowatts. It can produce its power output in temperatures as low as –40° F., and usually must operate under conditions demanding a minimum of attendance or supervision.

It is quite natural, therefore, that the oil purification equipment aboard should consist of a De Laval centrifugal machine. De Laval Oil Purifiers stand up under even the most rugged conditions, performing without failure the service for which they were designed — the removal of harmful impurities and water from lubricating oil. The constantly purified oil is enabled to protect the bearings indefinitely at full efficiency.

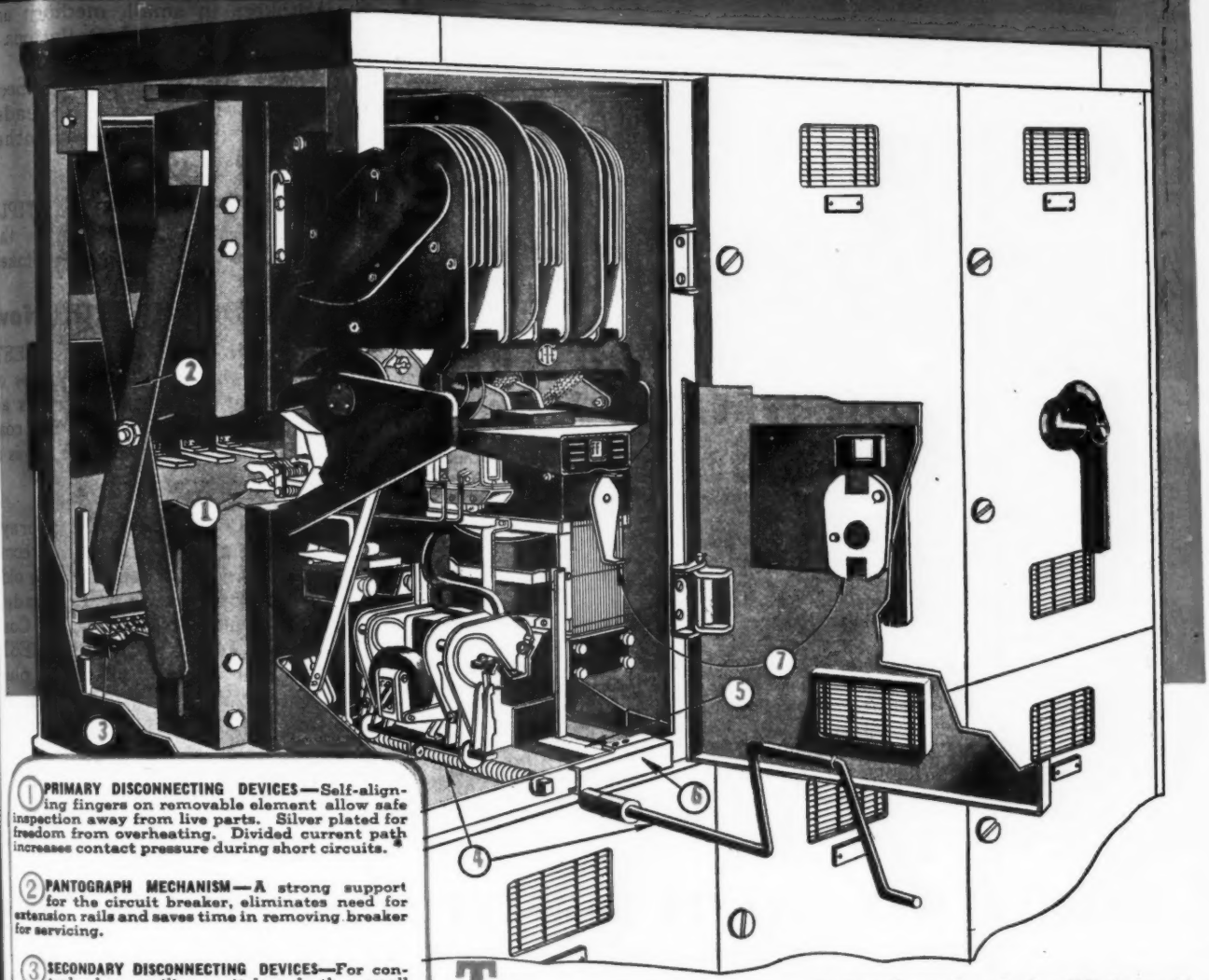
There is a range of types and sizes of De Laval Oil Purifiers to assure the proper machine for every power plant. Write for detailed information, sent without obligation.

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 19
THE DE LAVAL COMPANY, Limited
MONTREAL PETERBOROUGH WINNIPEG VANCOUVER

DE LAVAL OIL PURIFIERS

FOR MORE DEPENDABLE POWER PRODUCTION

Details of I-T-E Drawout Switchgear ARE WELL WORTH YOUR STUDY



1 PRIMARY DISCONNECTING DEVICES—Self-aligning fingers on removable element allow safe inspection away from live parts. Silver plated for freedom from overheating. Divided current path increases contact pressure during short circuits.

2 PANTOGRAPH MECHANISM—A strong support for the circuit breaker, eliminates need for extension rails and saves time in removing breaker for servicing.

3 SECONDARY DISCONNECTING DEVICES—For control relay, auxiliary switch and other small wiring circuits. Self-adjusting, silver plated. Flexible members mounted on removable element. Contacts closed at Test Position of breaker.

4 DRAWOUT SCREW AND REMOVABLE CRANK—Quick operating, triple-threaded screw allows fast drawout of breaker to Test or Removal Position. Crank has universal joint to allow operator to work comfortably.

5 INTERLOCK TRIP SHAFT—Provides safety for circuit and operator by actuating trip mechanism whenever the breaker is moved into or out of contact. Current cannot be broken on disconnecting devices.

6 INTERLOCK SLIDE—Connected to trip shaft, must be moved to expose end of drawout screw and allow removable crank to be attached. Crank cannot be in place with breaker closed.

7 OPERATING MECHANISM—Operating handle, furnished for both manually and electrically operated breakers, disconnects automatically from breaker when door is opened. Manual operation requires only a ninety degree turn of the handle.

There is a specific reason behind each of the Multumite switchgear details described here . . . either improved performance, safety or convenience. Close study will indicate how completely every contingency is provided for and the thoroughness with which each detail is engineered.

Only a few of the many features necessary to proper circuit breaker protection are mentioned. Catalog 6002 fully identifies and illustrates the requirements for dependable performance, safety and convenience in control and distribution of electric power. Call your nearest I-T-E representative for Catalog 6002 or write to I-T-E Circuit Breaker Company, 19th and Hamilton Streets, Philadelphia 30, Pa.

Representatives in Principal Cities

I-T-E AIR SWITCHGEAR

SAVE COAL...

with FYR-FEEDER Multiple SPREADER Stokers

FYR-FEEDER stoker firing not only saves coal, but also permits you to burn any kind of wet or dry bituminous coal you have available locally — screenings or sweepings, any melting point of ash, free-burning or coking coals.

Burns Coal like Oil: FYR-FEEDER burns fines in suspension, burns larger pieces on grate. Coal is spread over entire fuel bed. Thin fuel bed — no clinkers. Fires can be cleaned in two minutes! Suitable for large or small boilers. Very little maintenance cost. In many cases FYR-FEEDER stokers have made it unnecessary to add another boiler to handle increased loads.

FYR-FEEDER is our own original design. FYR-FEEDER is not a copy of any other stoker but our own invention developed by us, and our engineering experience with spreader stoker design, installation and operation began in the last century.

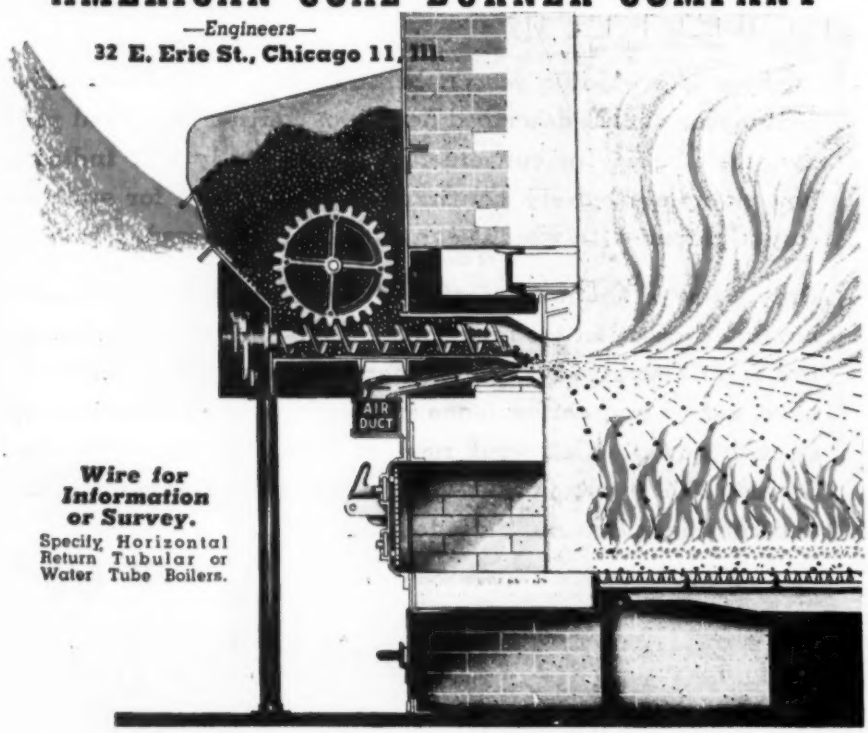
WET COAL IS NO HANDICAP

Coal men like the FYR-FEEDER because FYR-FEEDER users do not insist upon the delivery of "DRY" coal since FYR-FEEDER handles "WET" coal satisfactorily. Regardless of "rain and snow watered" coal, FYR-FEEDER stokers produce plenty of steam from "WET" coal. FYR-FEEDER was designed to use "WET" coal or dry coal.

AMERICAN COAL BURNER COMPANY

—Engineers—

32 E. Erie St., Chicago 11, Ill.



Wire for Information or Survey.

Specify Horizontal Return Tubular or Water Tube Boilers.

TREND TO SPREADER STOKERS

There is a definite trend to the use of more and more Spreader Stokers in small, medium and large Industrial Installations.

WHY do so many engineers now consider the Spreader Stoker superior to all other methods of coal firing?

THE FYR-FEEDER MULTIPLE SPREADER STOKER is the World's BEST Spreader Stoker.

The Best Is Vital Now

In ordinary times it is BEST to get the BEST. In times of emergency, when there is an urgent demand for saving coal and man-power, the BEST is a vital necessity.

The **FYR-FEEDER** Spray-Spred method of firing combines the advantages of the old-style conventional Spreader Stoker and the Pulverized Coal Burner, using only the BEST features of each method plus other **FYR-FEEDER** advantageous features.

The following questions present themselves:

I. WHY is the FYR-FEEDER superior to all other types of Spreader Stokers?

II. WHY is FYR-FEEDER the World's Simplest Automatic Stoker?

III. WHY is FYR-FEEDER the best Industrial Bituminous Coal Burner?

IV. WHY and how does FYR-FEEDER save coal and man-power?

V. WHY and how does FYR-FEEDER reduce maintenance costs?

VI. WHY is FYR-FEEDER the best method of burning WET or dry "coal screenings," bug dust or yard sweepings?

Fyr-Feeder Stoker Sizes

FYR-FEEDER Multi-Burner Stokers are built in sizes that will burn from 300 to 12000 lbs. of coal per hour. If you expect to be in the market for Automatic Coal Burning Equipment —WIRE

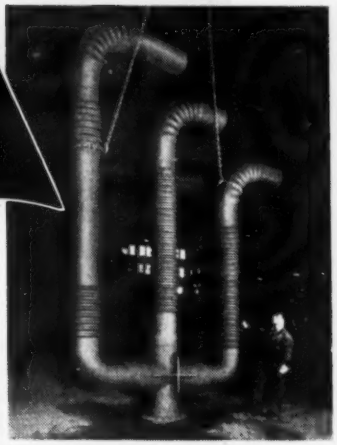
FYR-FEEDER

Spreader Stokers

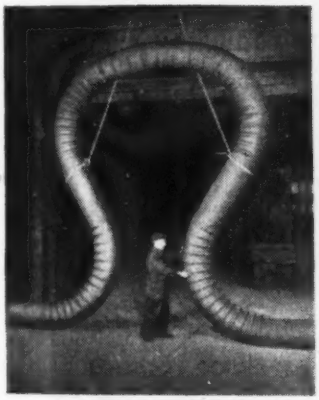
Chicago 11, Ill.

© by American Coal Burner Co., 1944

•Relieve Stress
•Save Space
•Simplify Operation



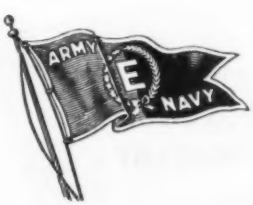
THRU PROPER USE OF CREASED BENDS AND SUPER-FLEXIBLE CORRUGATED TANGENTS



CORRUGATED piping, creased bends, or super-flexible corrugated tangents are not a panacea for all piping troubles, but their proper incorporation in a piping system will relieve undue stresses, strains, and end-reactions against equipment.

Because Pittsburgh Piping and Equipment Company Corrugated Tangents are at least five times as flexible as a piece of straight pipe of the same length, diameter and wall thickness, their proper use allows more convenient location of valves and assures a more compact, efficient system with consequent economical operation.

Our engineering department will be glad to show you how and where this type of fabrication can be used to your advantage when planning replacements, additions, improvements, or complete new piping systems.



Do More Than Before—
Buy EXTRA War Bonds

Pittsburgh Piping
AND EQUIPMENT COMPANY
10 Forty-Third Street—Pittsburgh, Penna.

Woolworth Building, New York
Occidental Building, Indianapolis
Book Tower, Detroit
Peoples Gas Building, Chicago
Public Square Building, Cleveland
10 High Street, Boston
525 Market Street, San Francisco

"FOR 23 YEARS THIS ENGINE HAS DELIVERED EFFICIENT, DEPENDABLE PERFORMANCE WITH Gulf Parvis Oil —"

says this Superintendent

Actual photo of a Gulf Service Engineer consulting with Superintendent on Diesel engine lubrication.

"This engine has operated efficiently and dependably since it was installed in 1921—and the high quality of Gulf Parvis Oil has been an important factor in this outstanding performance," says the Superintendent of the Southwestern Public Service Company, Mexia, Texas. "Proper lubrication has paid us big dividends for 23 years—our maintenance costs have been remarkably low, and we have a record of uninterrupted service to our customers."

There are good reasons for the outstanding performance of Gulf Parvis Oil in hundreds of Diesel engines. This higher quality lubricant is manufactured from selected crude oils by the most modern refining methods. And built into it is superior lubricating value and longer life—two assets that insure less wear, lower maintenance costs, and efficient, dependable Diesel operation.

If you are not one of the hundreds of enthusiastic users of Gulf Parvis Oil, it will pay you to investigate—call in a Gulf Lubrication Service Engineer and ask him to recommend the proper grade to fit your particular requirements. Write, wire, or phone your nearest Gulf office today.

GULF INDUSTRIAL LUBRICATION

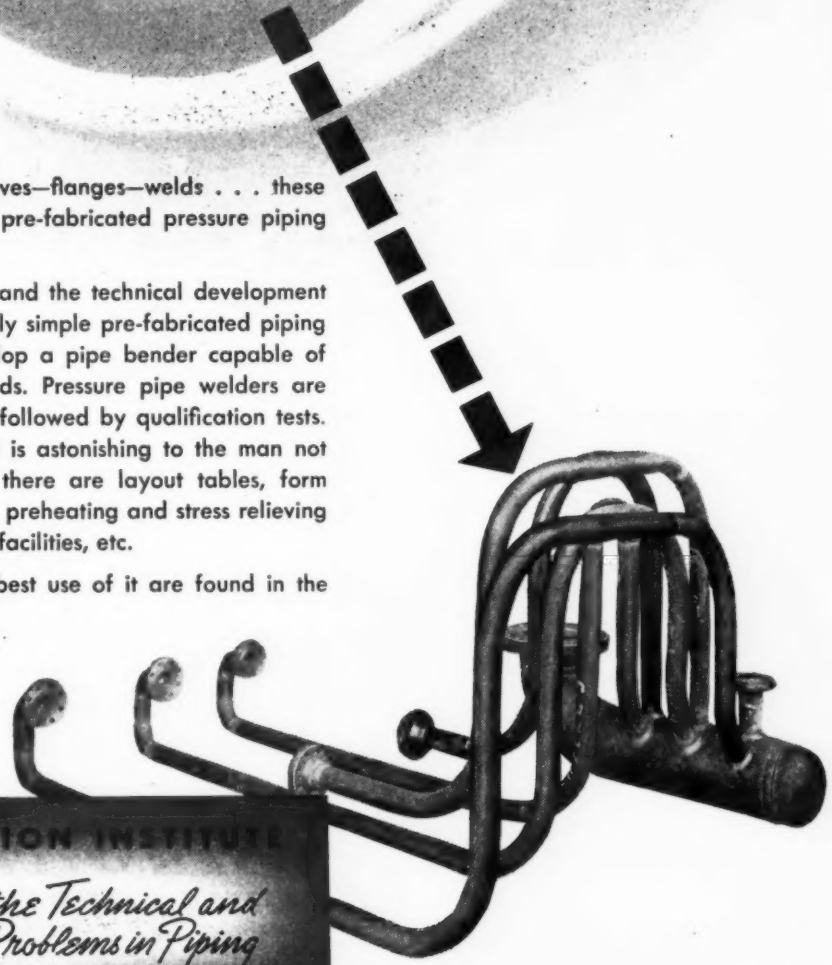
GULF OIL CORPORATION
GULF REFINING COMPANY
GULF BUILDING, PITTSBURGH 30, PA.

THERE IS MUCH MORE TO PRE-FABRICATED PRESSURE PIPING THAN MEETS THE EYE

Straight pipe—bends—laps—fittings—valves—flanges—welds . . . these are the things that meet the eye in a pre-fabricated pressure piping subassembly.

What isn't seen is the skill, experience and the technical development that went into the making of a seemingly simple pre-fabricated piping subassembly. It requires years to develop a pipe bender capable of producing consistently satisfactory bends. Pressure pipe welders are the result of long and careful training followed by qualification tests. The amount of special equipment used is astonishing to the man not familiar with pipe fabricating plants; there are layout tables, form cutting machines, work rotating fixtures, preheating and stress relieving equipment, straightening tables, testing facilities, etc.

This equipment and the skill to make best use of it are found in the shops of qualified pipe fabricators. Hence, they can save the user time and trouble and money on piping.



THE PIPE FABRICATION INSTITUTE

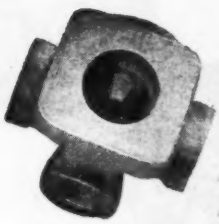
P.F.I. THE PIPE FABRICATION INSTITUTE

Devoted to the Technical and Economic Problems in Piping

1108 CLARK BUILDING, PITTSBURGH, PA.

G-8

SIVYER STEEL CASTINGS



TO MAKE GOOD CASTINGS

And Sivyer has these men . . . experienced men . . . men who have spent years in the casting business . . . who have lived with castings and know all there is to know about them.

Yes, it's these old-timers who so greatly help make Sivyer steel castings . . . better castings. Hand in hand with this human experience, goes the most modern in scientific foundry methods . . . the finest in equipment. Adding these together, you have the reason why particular users prefer steel castings bearing the Sivyer diamond —the mark worth looking for.

SIVYER STEEL CASTING COMPANY
MILWAUKEE CHICAGO

ARMY E NAVY

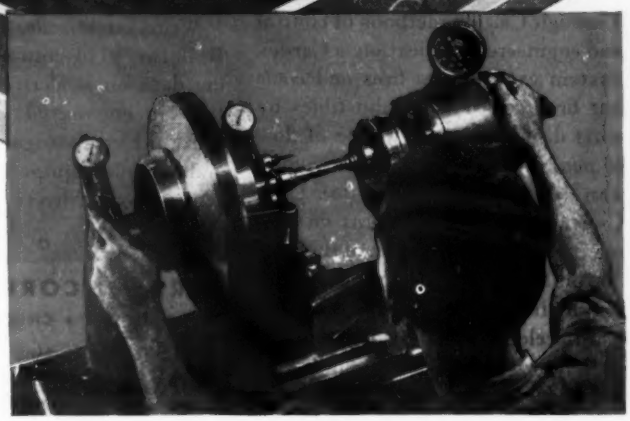
Pacific

FOR HIGH EFFICIENCY PUMPING OPERATIONS

IN Pacific's 20 years of precision pump building experience, there has never been a pumping problem encountered that Pacific Pumps couldn't lick . . .and with top efficiency, too!

Every type and size of pump in Pacific's entire line is scientifically correct in design and construction. No matter what your requirements may be . . . a single pump or complete plant facilities . . . Pacific can furnish the right equipment to do the job efficiently and economically.

The above illustrated Pacific Type JB Centrifugal Pump is designed for boiler feed and hot water circulating systems. Available in 2 to 8 stages, sizes 1½" to 6", speeds to 3600 R.P.M., capacities to 1600 G.P.M., differential pressures to 1000 lbs., operating temperatures to 500° F. Catalog No. 80 gives full engineering data. Write for your copy!



Pacific's rigid specifications demand Impeller perfection. On this specially designed machine, sensitive to split-hair measurement and register, each Pacific Impeller is tested for dynamic balance. Result . . . smooth, vibration-free performance . . . long, efficient pump life.

PACIFIC PUMPS, INC., Huntington Park, Calif.
One of the Dresser Industries
Export Office: 30 Rockefeller Plaza, New York

PACIFIC *Engineered* PUMPS

LOOK TO CARDOX

for cooperation in planning MODERN FIRE PROTECTION

Let CARDOX Engineers help you analyze the fire protection needs of your post-war plants and manufacturing processes. Whether the hazards call for a fixed system, mobile equipment, or a combination of the two, Cardox protection, engineered and planned for the specific hazards it covers, provides for quick extinguishment with minimum damage to buildings and their contents.

Advantages of Cardox Engineered Fire Protection

Through Cardox methods of control and engineered application, a Cardox System extinguishes fires and cools out fire zones and combustibles by *mass* discharge at high rate of flow of *pounds* or *tons* of non-damaging, non-contaminating Cardox CO_2. Control may be fully automatic, manual, or a combination of the two. Automatic systems include actuation by heat detectors, pre-discharge alarm, release of doors and windows, shut down of fans and motors and essential related functions.

Uniform, Enhanced Extinguishing Performance

Carbon dioxide, one of the fastest of all fire extinguishing mediums, is given uniform, enhanced performance by the Cardox method of control and application. For example, Cardox CO_2 has uniform extinguishing characteristics regardless of plant or atmospheric temperatures; its high CO_2 snow yield provides increased cooling effect (carbon dioxide released at 0°F. yields 45% CO_2 snow); and, because of high CO_2 snow yield and special engineering of Cardox nozzle, accurate projection is achieved through relatively great distances.

Write on business letterhead for Bulletin 9114 containing interesting data on modern fire protection through engineered applications of Cardox Fire Extinguishing Systems and mobile equipment of special interest to architects.

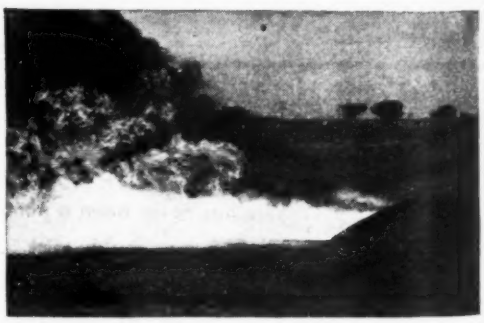
o

CARDOX CORPORATION
BELL BUILDING • CHICAGO 1, ILLINOIS
New York • Boston • Washington
Detroit • Cleveland • Atlanta • Pittsburgh
San Francisco • Los Angeles • Seattle

BUY WAR BONDS

CARDOX
CO_2 FIRE EXTINGUISHING SYSTEMS

In this demonstration of the speed and efficiency of a Cardox Fire Extinguishing System under extreme conditions, 100 gallons of quenching oil, primed with gasoline, was allowed to burn long enough to develop maximum burning rate and heat.

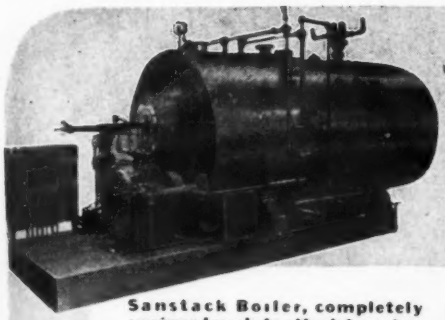


At the height of the burning period a mass discharge of Cardox CO_2 was applied from fixed linear nozzles on two sides of the 10'x20' test pool. Note in picture above how the mass discharge of Cardox CO_2 is enveloping the fire zone.

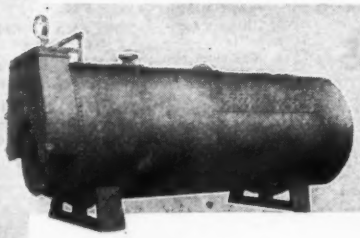
Complete extinguishment and cooling below re-ignition temperature was accomplished in total discharge time of 33 seconds. Note CO_2 snow on oil surface.

Wherever Dependable Heating or Power is needed

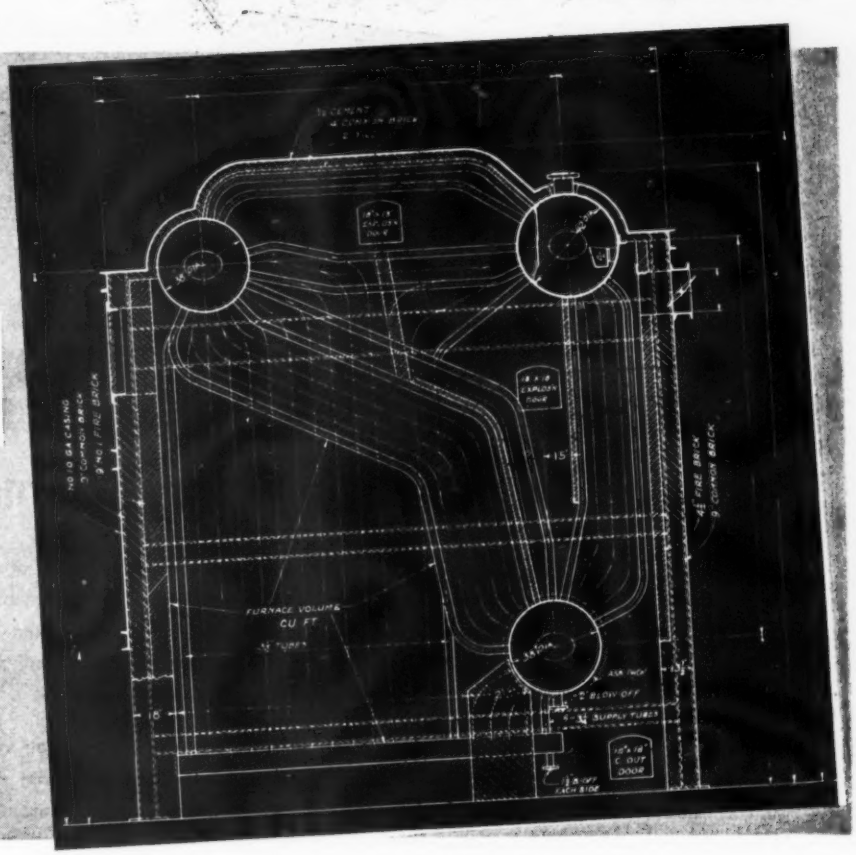
TITUSVILLE BOILERS are first choice



Sanstack Boiler, completely equipped ready to attach to water oil and electric lines. Available from 50 to 500 H.P., 125 pound to any desired working pressure.



TITUSVILLE power and heating units, designed and fabricated to specific pressures, temperatures and types of service.



Titusville designs and builds ALL types of Power and Heating Boilers to fit specific job requirements These modern boilers embody the many new manufacturing and material developments that make for maximum efficiency, dependable ruggedness and lower operating costs.

Titusville boiler engineers are available anytime, anywhere to aid in solving your boiler requirements

Dependable Boilers Since 1850

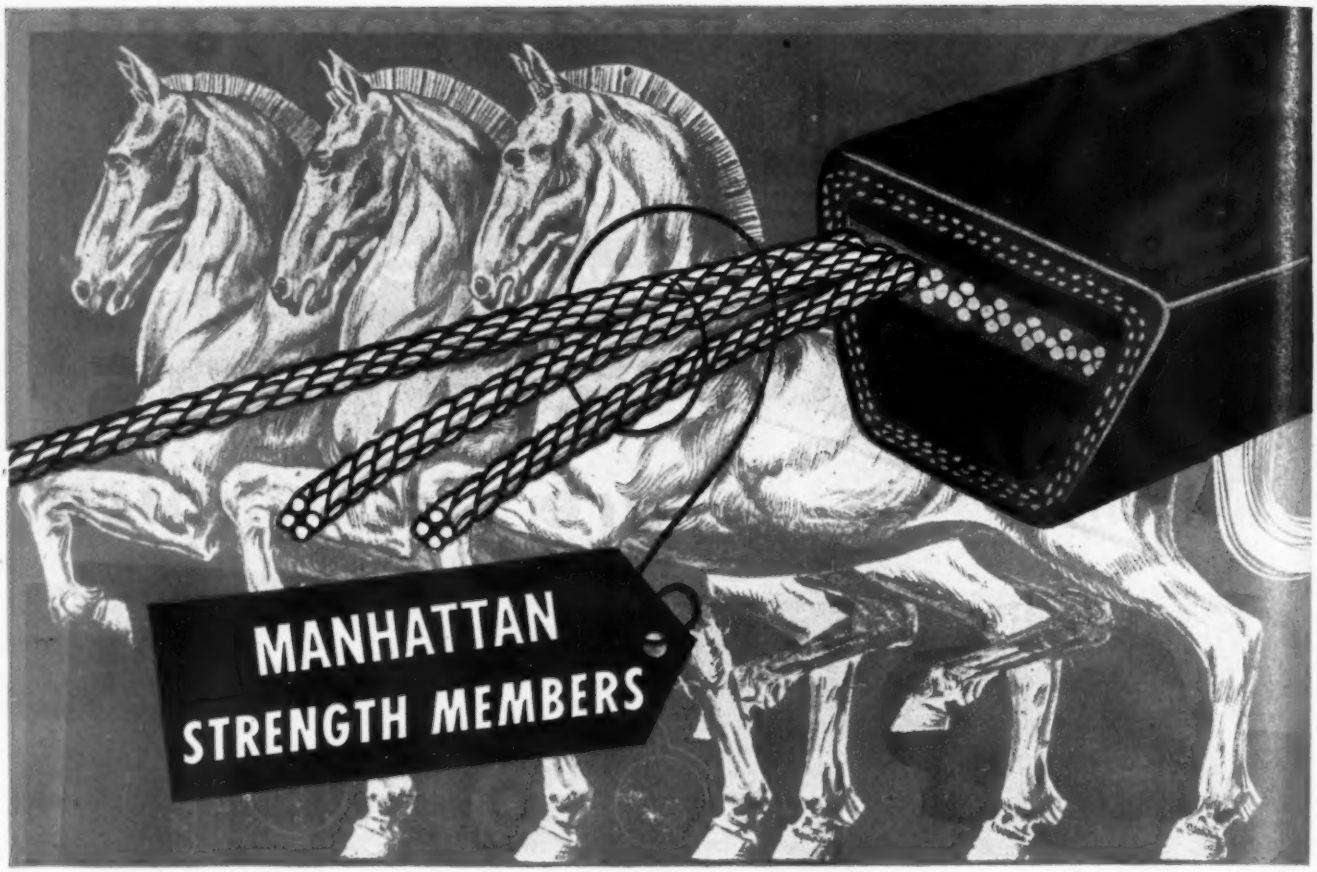
FABRICATED TO ALL BOILER CODE SPECIFICATIONS

STRUTHERS WELLS CORPORATION

TITUSVILLE BOILER DIVISION

PLANTS AT TITUSVILLE, PA. AND WARREN, PA.

Offices in Principal Cities



in *Condor* V-BELTS

put your horsepower in Victory's harness

—through flexibility, lasting service and extreme lack of stretch. Stout, tough strands of pre-stretched cords in the Whipcord Neutral-Axis Section, carry the load smoothly from motor to machine. These Whipcords—the load-carrying sinews in Condor V-Belts—fortify the FLEXLASTICS* in which they are embedded and through which they dissipate the heat from internal friction and high-speed flexing.

Outwardly these basic qualities are not visible to the eye, but they confirm their value to you in months—often years—of added service, which is translated into more efficient power transmission, greater production, added profit and a better position when full-scale competition returns to enforce production cost control.

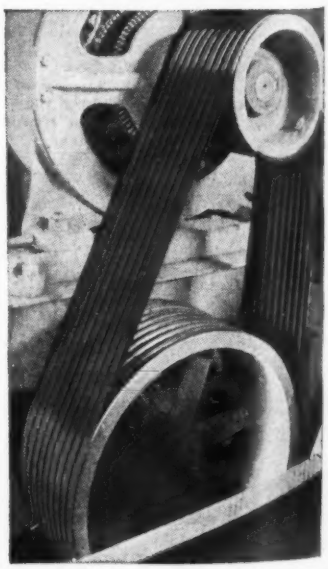
Condor V-Belts are only one of the many MANHATTAN industrial rubber products in which FLEXLASTICS,* with engineered and correctly placed Strength Members, deliver added service. The Condor Whipcord Strength Member is a MANHATTAN development.

Get ready now for the day when restrictions are dropped and write for the new Condor V-Belt Bulletin No. 6868B.**

8 POINTS OF BALANCE

1. Wide margin of strength
2. Minimum inelastic stretch
3. Uniform flexibility
4. Maximum resistance to structural breakdown
5. Smooth running
6. Maximum traction
7. High resistance to side wear
8. Correct lateral reinforcement

These 8 Points correctly embodied in every Condor V-Belt. Other factors being equal, the useful life of a V-Belt is limited by excessive stretch.



** The term FLEXLASTICS is an exclusive MANHATTAN trade mark. Only MANHATTAN can make FLEXLASTICS.*

*** Condor V-Belts are now made in the dark, war-time color.*

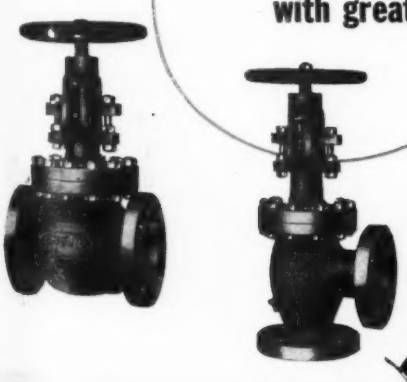
KEEP AHEAD WITH MANHATTAN

THE MANHATTAN RUBBER MANUFACTURING DIVISION
OF RAYBESTOS-MANHATTAN, INC.
EXECUTIVE OFFICES PASSAIC, NEW JERSEY

KEROTEST ENGINEERING AND RESEARCH ARE WORKING "ROUND-THE-CLOCK"

Planning and Perfecting PRECISION VALVES

with greater Economy and Reliability for your Postwar Needs



Kerotest engineers have burned a lot of "midnight oil" in the past four years—first, in finding ways and means of designing and building Valves for War, at a terrific production pace and in tremendous quantities. Then, adapting this war-learned skill to designing Valves for Peace that will set new standards of quality, dependability and economy.

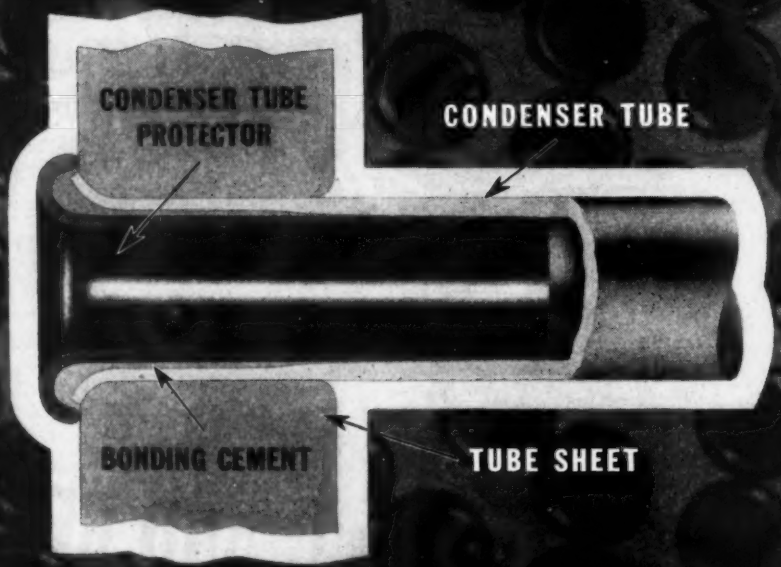
Kerotest is ready now to meet your most difficult peacetime needs.

KEROTEST

KEROTEST MANUFACTURING CO.
PITTSBURGH, PA.

JOHN CRANE

Condenser Tube Protectors



ELIMINATE

Tube End Thinning - Tube End Erosion - Sand Abrasion

- Protect condenser tube inlet ends against air erosion, sand abrasion, and tube thinning.
- These *new* Condenser Tube Protectors are molded of a special wear-resistant hard bakelite material, unaffected by temperatures to 275° F.—Resistant to contaminated salt and fresh condenser circulating water and air impingement.
- Easily installed and quickly, in both old and new tubes; securely cemented in place.

NOW MANUFACTURED FOR:

5/8" 16 or 18 Gauge Tubes	7/8" 18 Gauge Tubes
3/4" 16 or 18 Gauge Tubes	1" 18 Gauge Tubes

- Increase the life of condenser tubes; save critical metals. John Crane Condenser Tube Protectors pay for themselves time and time again in longer tube life.
- For further information consult branch office nearest you.

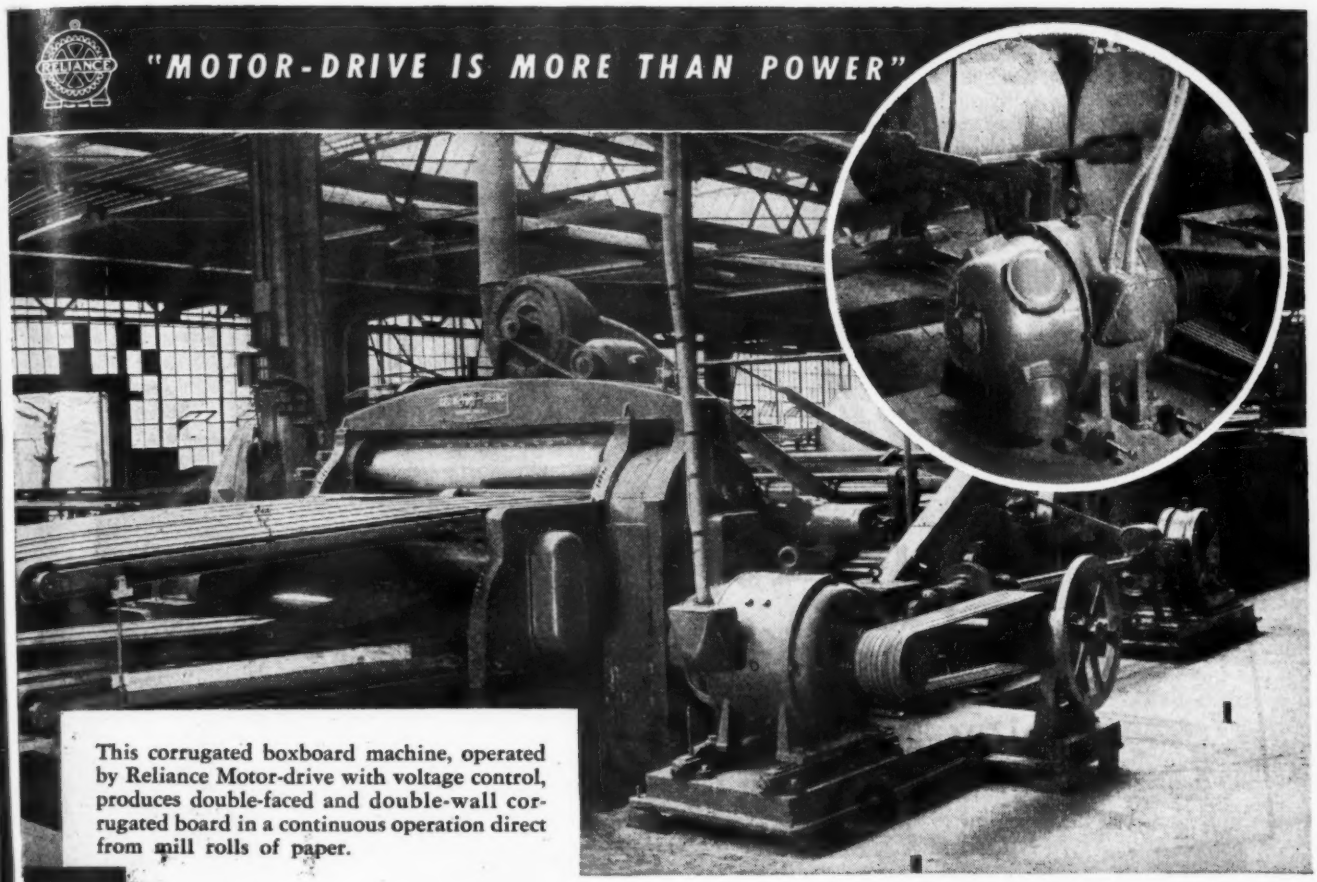
CRANE PACKING COMPANY

1811 CUYLER AVE. • CHICAGO 13, ILL.

BALTIMORE, BOSTON, BUFFALO, CLEVELAND, DALLAS, DETROIT, HOUSTON, LOS ANGELES, NEW ORLEANS, NEW YORK, PHILADELPHIA, PITTSBURGH, SAN FRANCISCO, ST. LOUIS, TULSA

CRANE PACKING CO., LTD., Hamilton, Ontario, Canada.
Branches: Montreal, Toronto, Vancouver

"MOTOR-DRIVE IS MORE THAN POWER"



This corrugated boxboard machine, operated by Reliance Motor-drive with voltage control, produces double-faced and double-wall corrugated board in a continuous operation direct from mill rolls of paper.

. . . DOES YOUR WORK REQUIRE FREQUENT STARTING, STOPPING and SPEED CHANGES?

Acceleration of this corrugated boxboard machine from zero to full speed is attained in less than 10 seconds through use of Reliance Motor-drive with voltage control. By comparison, at least two minutes were required with the types of mechanical controls formerly used. Saving in stopping time is even greater. Proper tension is maintained at all times and the speed of all sections synchronized to avoid breaks or damage to the material. Both quantity and quality of output are increased through the smoother, speedier response provided by this new method of control.

When there's a job of machine design to be done, or you are looking for ways to improve production methods, invite a Reliance man to sit in. His specialized knowledge of electric motor-drive can be a big help.

RELIANCE A·C D·C MOTORS

RELIANCE ELECTRIC & ENGINEERING CO.
1088 IVANHOE ROAD • CLEVELAND 10, OHIO

Birmingham • Boston • Buffalo • Chicago • Cincinnati • Detroit • Greenville (S.C.) • Houston • Los Angeles • Minneapolis • New York
Philadelphia • Pittsburgh • Portland (Ore.) • St. Louis • Salt Lake City • San Francisco • Syracuse • Washington, D.C. • other principal cities

FIT THE VALVE TO THE SERVICE

WALWORTH

Steeliron

LUBRICATED PLUG VALVES

No. 1796 — SCREWED
No. 1797F — FLANGED

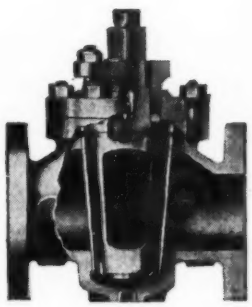
No. 1796

for working pressures up to 175 lbs. O.W.G.

This Walworth lubricated plug valve meets a wide range of requirements, and also helps to conserve critical copper. Made of close-grained, high strength cast iron, it uses insoluble lubricants to assure tight-sealing, easy operation, and resistance to corrosion and wear. This valve is made in sizes from 1" to 4", with screwed or flanged ends.

Other Walworth Lubricated Plug Valves are made in sizes from 1/2" to 24", for pressures from 125 to 5,000 psi., and for vacuum requirements. They are particularly adaptable for control of gritty solutions and many other erosive and corrosive industrial and chemical solutions. For complete information on Walworth Lubricated Plug Valves, write for a free copy of Walworth Circular No. 91.

Walworth also manufactures a complete line of gate, globe and check valves, as well as pipe fittings and pipe wrenches. Walworth Catalog 42 gives detailed information. Write on your company letterhead for a free copy.



Just a turn of the lubricant screw on a Walworth Lubricated Plug Valve forces insoluble lubricant under pressure through a grooving system and down beneath the plug. The lubricant seals the valve against leakage in either open or closed position, reduces friction between plug and body, and helps protect plug and body against contact with corrosive line fluids.

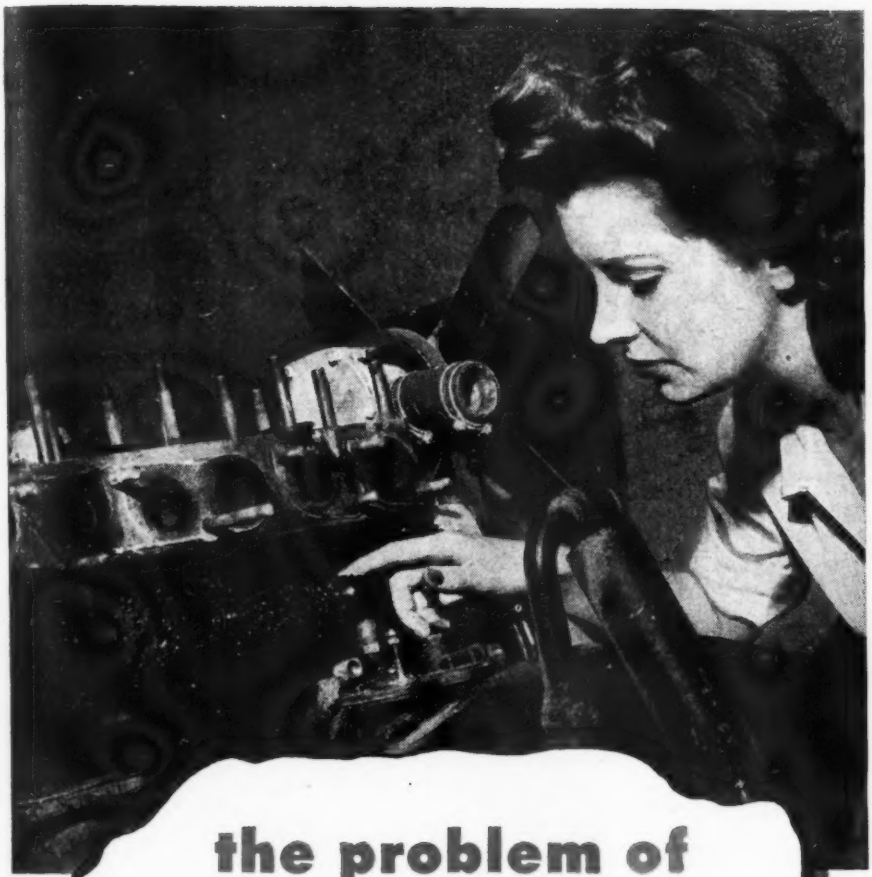
These are some of the features which make Walworth Lubricated Plug Valves ideal for many "difficult" services.

ARMY-NAVY E

BOSTON WORKS
KEWANEE WORKS

WALWORTH
valves AND fittings
60 EAST 42nd ST., NEW YORK 17, N.Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD



the problem of SLUDGE

IT IS well known among automotive engineers that engine deposits (sludge) cause stoppage of oil circulation, sticky rings, oil pump trouble and other serious damage resulting in overhaul time and expense.

Sludge either stays in suspension in the oil and causes the lubricant to become black, or it sticks to the motor parts and does its dirty work of destruction.

LOW AND HIGH TEMPERATURE SLUDGE

There are two general types of sludge—that caused by low temperature operations and that by high.

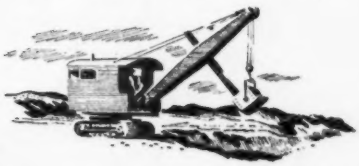
Low temperature sludge is usually a semi-solid material with the consistency of soft mud. It is composed of oil mixed with water and fine particles of carbon, metal, dirt, dust or fuel gums.

"Stop and Go" operation with prolonged idling of the motor is a common cause of low temperature sludge. A leak in the water system surrounding the cylinders may also be responsible. Low temperature sludge clogs the oil lines and screens, resulting in burned out bearings and scuffed cylinder walls.

The principal difference between high temperature sludge and low is that the former contains large amounts of resins resulting from the oxidation of the oil in the crankcase. This type of sludge is comparatively free from water and soot.

High temperature sludge produces two different kinds of deposits in the engine. The granular or "coffee ground" sludge in the crankcase or oil pan and on the surface of the pump screen is well-known to mechanics. Varnish, gummy or lacquer-like deposits that form on piston and ring faces and cylinder walls, because of high temperature oxidation of thin oil films, is another kind.

High temperature sludge is caused from prolonged high speed and engine operation, overloading the engine, clogged radiator or cooling system.



HOW TO REMEDY SLUDGE SITUATION

Low temperature sludge can be easily recognized by simply heating some of the deposit on a piece of metal over a flame. If the material foams or sputters and crackles, then water is present. To remedy this, check for internal water leaks and raise the temperature of the cooling water to 160° to 180° and keep it there by means of radiator shutters or thermostats.

To remedy high temperature sludge, inspect radiators and water jackets and see that they are clean and free of mud and scale. Drain and flush crankcase frequently, especially in heavy duty service. Oxidation of the crankcase oil can be minimized by the use of oil coolers in heavy duty truck service. Keep the crankcase oil temperature below 200° F.

To prevent either type of sludge, keep the lubricating oil clean. Filtering is not enough. Frequent draining and flushing of the crankcase is essential. Drain oil while hot. Base drain periods on a type-of-use basis, rather than time or mileage interval. Keep both air and oil filters free from dust and other foreign matter.

MACMILLAN RING-FREE OIL HELPS REDUCE SLUDGE—*One of your most effective sludge remedies is a good lubricating oil. Macmillan Ring-Free Motor Oil (for either Diesel or gasoline fuels) is so refined that it removes the carbon and sludge from the working parts of the engine. It cleanses as it lubricates. The deposits are kept in the oil in suspension and are drained off when you change oil. That's why Ring-Free is black when it's drained.*

You'll be surer of fewer motor troubles with Ring-Free Oil.

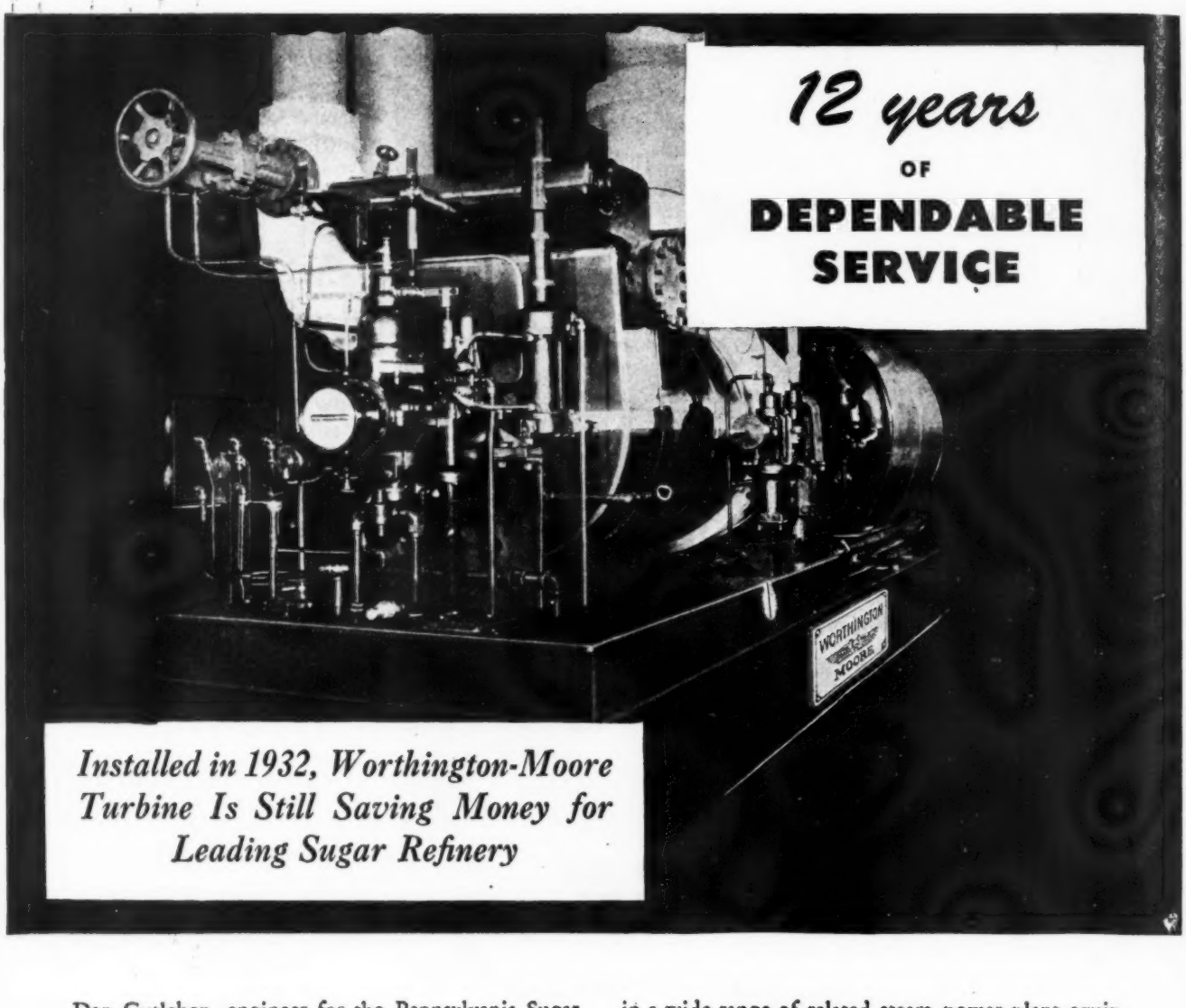
Free Folder on Sludge—Its Causes and Cures

Write today for your copy • Address: Macmillan Petroleum Corp., 530 W. Sixth Street, Los Angeles 14, Calif.

MACMILLAN RING-FREE MOTOR OIL

MACMILLAN RING-FREE MOTOR OIL

MACMILLAN PETROLEUM CORPORATION—50 WEST 50TH STREET, NEW YORK 20 • 624 SOUTH MICHIGAN AVENUE, CHICAGO 5 • 530 WEST SIXTH STREET, LOS ANGELES 14 • COPYRIGHT 1944, MACMILLAN PETROLEUM CORPORATION



Installed in 1932, Worthington-Moore Turbine Is Still Saving Money for Leading Sugar Refinery

Dan Gutleben, engineer for the Pennsylvania Sugar Company, recently wrote: "Our Worthington-Moore turbine rolls along every day and every night without stopping. It ran for years with very few shut-downs and no service expense whatever."

Electricity a By-product

This 2000 KW turbine-generator, like many other Worthington-Moore units, produces low-cost electricity as a by-product. It operates on steam at 400 lbs. pressure, 500°F. total temperature, 12 lbs. back pressure and automatically extracts steam at 90 lbs.

Engineering the Right Turbine for the Job

Experienced in special turbine applications, as well as in a wide range of related steam power plant equipment, Worthington-Moore engineers are especially fitted to recommend the best type of unit for your particular requirements. *Worthington Pump and Machinery Corporation, Moore Steam Turbine Division, Wellsville, New York.*

WORTH BEHIND THE NAME
WORTHINGTON
MOORE

MR4-6

A GREAT TEAM IN STEAM

Precision control of heating—this is exactly what the Minneapolis-Honeywell Weatherstat Control System provides. The Weatherstat goes right to the source that governs all heating plants—outside weather conditions.

Fuel savings from *twenty* to *forty* percent are reported by building owners and operators after installation of this control system. Substantial as these savings are, they are not surprising when you consider how the Weatherstat works. Instead of waiting for the effects of weather changes to be felt inside the building, the Weatherstat, because it is located outside, *immediately* governs the action of the heating plant. No longer is it necessary, for example, to carry a full heating load merely in anticipation of extreme temperatures.

Owners and operators of commercial, industrial and apartment buildings can get complete information now about the Weatherstat Control System which is available without priorities. Without obligation, you can have a Honeywell Engineer explain the specific benefits you can expect. Just write the Minneapolis-Honeywell Regulator Company, 2702 Fourth Avenue South, Minneapolis 8, Minnesota. Branches and distributing offices in all principal cities.

MINNEAPOLIS Honeywell
CONTROL SYSTEMS

Specify Ladish *Controlled Quality* Forged Steel Pipe Fittings

Ladish forged steel fittings, carbon and alloy, are produced under exacting metallurgical control. Every Ladish fitting bears the symbol of Controlled Quality—the Ladish Heat Code.

Forged Steel Screwed Fittings

Full depth thread, accurately cut, results in pressure-tight joints. Pipe enters easily. Uniform thickness. Sizes clearly marked . . . ⅛" through 4".

Socket Welding Fittings

Speed up installation because deep sockets save time formerly required to cut pipe to exact length. Socket supports pipe and allows self-alignment. No machining of pipe necessary for fit. ASSURED WELDABILITY. Sizes clearly marked . . . ⅛" through 4".

TO MARK PROGRESS

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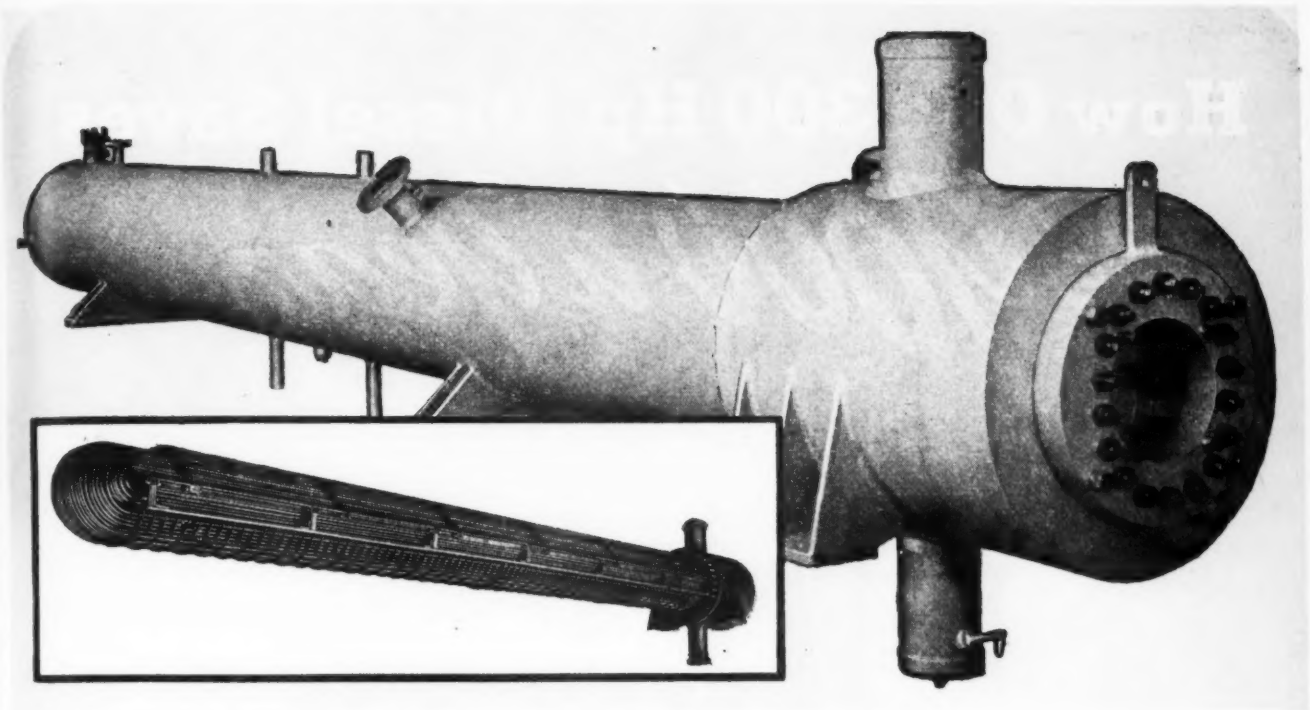


This G-R STAGE HEATER combines

SIMPLICITY... because the U-tube construction and tube sheet integral with water head requires a minimum of high pressure joints.

RUGGEDNESS... because of sturdy construction; including ample support of tubes, and prevention of vibration by minimum clearance at tube support plates.

ACCESSIBILITY... because the only high-pressure joint is a single manhole cover.

The design and construction of this unit is based on 76 years of experience in building heat transfer apparatus.

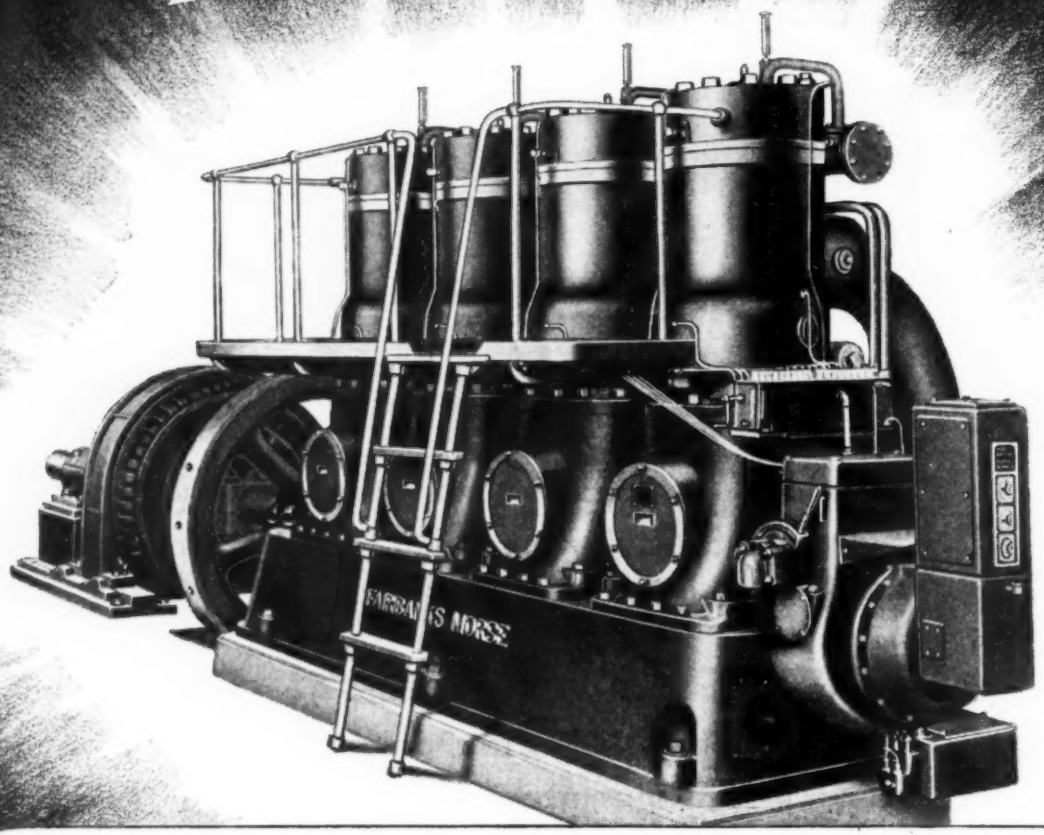
Write for Bulletin

The Griscom-Russell Co.
285 Madison Avenue
New York 17, N. Y.

GRISCOM-RUSSELL

Pioneers in Heat Transfer Apparatus

How One 300 Hp. Diesel Saves $9000 a Year



IN 1938 the Superior Packing Company installed one 300 hp. Fairbanks-Morse Diesel.

Since then it has put in 25,000 hours of service with only a few stops for routine inspection.

It operates at better than 90% capacity and overloads are frequent.

Year in and year out, this Fairbanks-Morse Diesel Engine saves over $9,000 a year for the owners. Long ago it paid off its original cost.

What Fairbanks-Morse Diesels have done for others, they can do for you. Write Fairbanks, Morse & Co., Fairbanks-Morse Building, Chicago 5, Illinois.

FAIRBANKS-MORSE

DIESEL ENGINES
PUMPS
MOTORS
GENERATORS
WATER SYSTEMS
SCALES
STOKERS
FARM EQUIPMENT
RAILROAD EQUIPMENT

Diesels

. . . cubic feet per minute

Let's imagine a stream of air cubes caught within some strong force that is squeezing them from their one-cubic-foot size down to smaller and smaller cubes . . . increasing the pressure within them . . . pushing them into a pipe . . . creating compressed-air power. Cube after cube flows on as we count *cubic feet per minute* . . . in short we say *cfm*.

Emerging somewhere from the end of a distribution pipe these compressed cubes are expanding . . . exerting compressed-air power, doing work. Finally, the cubes regain their original size and pressure . . . again become free atmosphere. Once more we count them . . . so many *cfm*.

Machines that squeeze or compress the air are called *air compressors*. Machines that use the compressed air to push a piston, or turn a wheel, are called *air tools* . . . drills, hammers, wrenches, hoists, and grinders. *Cfm* is the "yardstick" for measuring both the capacity of compressors and the air consumption of air tools.

But *cfm* is only one means of appraising these machines. On countless compressors and air tools, widely used throughout the world, both in peacetime and in war, you will find the IR trademark. This symbol stands for nearly 75 years of pioneering and development in the compressed-air industry. It is your assurance of a reliable machine that will economically produce or apply compressed-air power.

Air for power purposes is usually compressed to 100 pounds pressure in machines varying in size from 2 to 16,000 cfm, requiring from ½ to 3000 horsepower. But there are hundreds of other uses for compressors.

One example is a 2500-horsepower I-R compressor that inhales about 3600 cfm (a box-car full every minute) of nitrogen and hydrogen gas, squeezing the gas in seven steps to one-thousandth of its original size . . . increasing its pressure to 15,000 pounds . . . an important step in producing synthetic ammonia needed in the manufacture of explosives and fertilizers.

Consider also machines like a 15,000-horsepower I-R Turbo-Blower in a steel plant . . . compressing 125,000 cfm of air to 30 pounds for combustion in the blast furnaces.

Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y.

1-500

COMPRESSORS • TURBO-BLOWERS • ROCK DRILLS • AIR TOOLS • CENTRIFUGAL PUMPS • CONDENSERS • OIL AND GAS ENGINES

PROTECT YOUR OPERATING INVESTMENT

THE ROCKBESTOS CONSTRUCTION that provides long wire life

Rockbestos A. V. C. Power Cable, at left, and similarly insulated Motor Lead Cable (National Electrical Code, Type AVA) has a maximum operating temperature rating of 110° C. (230° F.) and this permanently insulated construction:

1 A tough, rugged asbestos braid, resistant to heat, flame, moisture, oil, grease and corrosive fumes.

2 Outer felted asbestos wall, impregnated with heat, flame and moisture resistant compounds, serves as an effective barrier against high ambient temperatures and flame.

3 Lubricated varnished cambric for high dielectric strength and added moisture resistance, protected from heat, flame and oxidation between two felted asbestos walls.

4 Felted asbestos insulation, also impregnated with heat, flame and moisture resisting compounds, withstands conductor heating overloads and won't dry out, bake brittle or burn.

5 The conductor is perfectly and permanently centered in helically applied insulation.

One of 122 different wires and cables developed for severe operating conditions by Rockbestos.

WON'T bake brittle, bloom, burn or rot.
RESISTS moisture, oil, grease and fumes.

Install ROCKBESTOS A.V.C.

In Lighting, Power and Control Circuits

Exposed to High Operating Temperatures

You can practically eliminate shut-downs and production delays caused by repeated wire-failures by installing Rockbestos A.V.C.—*the wire with permanent asbestos insulation*—in all electrical circuits that run around furnaces, lehrs, kilns, soaking pits, or in steam tunnels and other locations exposed to heat or severe operating conditions.

Rockbestos A.V.C. wires, cables and cords have a *permanent* impregnated asbestos insulation that stands up under operating temperatures ranging as high as 230°F. It is naturally heatproof, flameproof, and won't bake brittle, dry out, crack, bloom, rot or swell. It also resists heat, cold, moisture, oil, grease, alkalies, corrosive fumes and other destructive elements and gives trouble-free service where other constructions fail.

Protect your operating investment . . . install Rockbestos A.V.C. in lighting, power and control circuits operating in hot-spot locations. 122 constructions give you a wide range of selections to meet your specific requirements. When ordering or inquiring, please furnish priorities information required under CMP regulations. For complete information and samples, write nearest branch or:

ROCKBESTOS PRODUCTS CORPORATION

967 Nicoll St., New Haven 4, Conn.

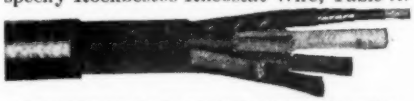
NEW YORK, BUFFALO, CLEVELAND, CHICAGO, PITTSBURGH, ST. LOUIS, LOS ANGELES, SAN FRANCISCO, SEATTLE, PORTLAND, ORE.

ROCKBESTOS 600 VOLT ALL-ASBESTOS RHEOSTAT AND POWER CABLE

(National Electrical Code, Type AI)

Sizes No. 18 AWG to 1,000,000 CM insulated with a heavy wall of felted asbestos, covered with a rugged asbestos braid finished in black, white or colors.

Use this power and rheostat cable for wiring rheostats, switchboards, elevator and locomotive control panels and electrical equipment exposed to heat, fumes and fire hazard. Also for general open wiring in dry, high temperature locations. For solid conductor specify Rockbestos Rheostat Wire, Table A.



ROCKBESTOS A.V.C. 600 VOLT CONTROL CABLE

In one to 19 conductors. Standard stranding AWG No. 12—19 /No. 25 and No. 9—19 /No. 22. Other strandings furnished.

Designed for use under conditions too severe for control cables with other types of insulation which deteriorate rapidly when exposed to high temperatures. This Rockbestos A.V.C. Cable operates without failure under the attack of heat, oil, grease or corrosive fumes and may be installed in conduit as it has ample moisture resistance.

ROCKBESTOS A.V.C.

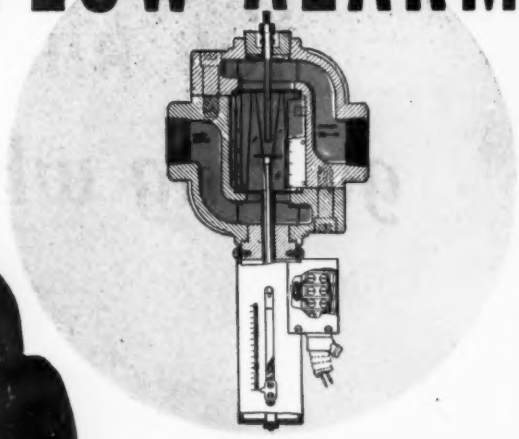
The Wire with Permanent Insulation

• BUY MORE WAR BONDS •

A NEW, POSITIVE FLOW ALARM

—actuated by flow rate changes

only!



ROTA-SIGHT FLOW ALARM

When the flow rate becomes dangerously high or low the Rota-Sight Alarm will flash a red light, start or halt electrical equipment, kick solenoid valves to a new position, or set off a raucous warning horn. Furthermore it definitely indicates the actual flow rate at all times.

The Rota-Sight Alarm operates through a float which moves up and down in a precision-bore transparent metering tube, into which triangular flutes have been fashioned. As the float rises, the flow passage through these flutes increases, causing the float to assume a position in the tube in direct proportion to the amount of liquid or gas passing through the meter. Thus the float responds to flow rate changes ***only***. A magnetic extension attached to the float trips an external switch to operate the alarm circuit through a suitable relay. The switch operates ***accurately*** and ***positively*** at the flow rate for which it is set, and is readily adjustable over the entire flow range of the Rota-Sight.

This remarkable flow rate alarm is compact, inexpensive and easy to install. It is available in sizes from ¼" and up, in any metal that can be cast. It may be obtained with single alarm, or with double alarm for high and low flow protection. For inflammable or explosive fluids, the alarm fixture may be made explosion-proof. Furthermore, without the alarm attachment, the Rota-Sight is a small, low-priced flow rate meter that will indicate the true flow rate continuously. Bulletin 92-B, containing a detailed description, will be sent gladly at your request upon your Company letterhead. Write to Fischer & Porter Co.,6011County Line Road, Hatboro, Pa.

FISCHER & PORTER COMPANY

You know what you're getting when you buy...

Champion Coal...!

THE NAME THAT MEANS FULL VALUE

PITTSBURGH COAL COMPANY

General Offices: OLIVER BUILDING • PITTSBURGH, PA.

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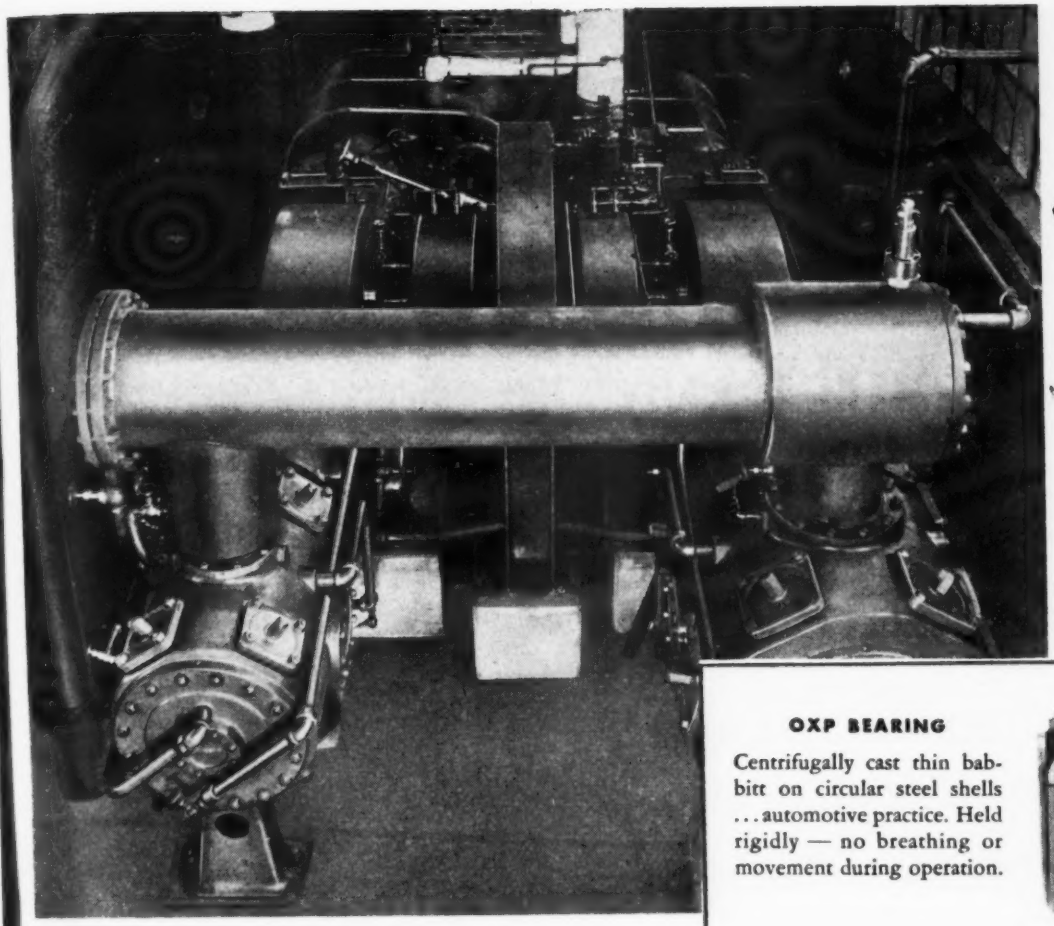
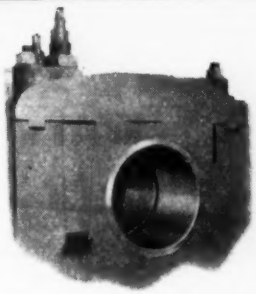
PITTSBURGH COAL CO., LTD., London, Ont., Hamilton, Ont., Toronto, Ont., Windsor, Ont.
PITTSBURGH COAL CO. of Wisconsin, Duluth, Superior, Minneapolis, St. Paul • MILWAUKEE-WESTERN FUEL CO., Milwaukee, Wisconsin



A Worthington OXP$_2$ Feather Valve Compressor as installed by a large manufacturer of metal products.

OXP BEARING

Centrifugally cast thin babbitt on circular steel shells . . . automotive practice. Held rigidly — no breathing or movement during operation.



PLAIN TALKS with a Worthington engineer will help you get the most from that big, heavy-duty compressor installation you have in mind.

For more than 40 years, Worthington has accumulated data on the application of compressors to the air and gas compression problems of power plants . . . refineries . . . manufacturing industries from coast to coast.

Write for "Plain Talks on Air and Gas Compression", a factual, practical series of articles by Worthington engineers. *Consult* with a Worthington specialist in planning your next compressor installation . . . his experience is available to you without cost or obligation. *Worthington Pump and Machinery Corporation, Buffalo Compressor Division, Buffalo, N. Y.*

5 Other Reasons for More Worth in this Heavy-Duty Worthington

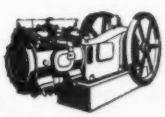
1. ***Bronze Type Inter-Cooler Tubes*** — lowest power consumption.
2. ***Balanced-Piston Steam Valves***—high steam pressures and temperatures provide best steam economy.
3. ***Full Force Feed Lubrication***—only a Worthington steamer gives you this decided advantage.
4. ***Class "30" Automatic Governor*** — the positive, sensitive, simplest method of regulating compressor by automatically changing steam cut-off . . . with improved steam economy.
5. ***Smooth, Balanced Operation***—heavily counter-balanced cranks reduce vibration and operation strains.

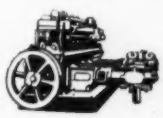
WORTH BEHIND THE NAME
WORTHINGTON

AC4-18

NO OTHER COMPRESSOR WILL OUTPERFORM A WORTHINGTON

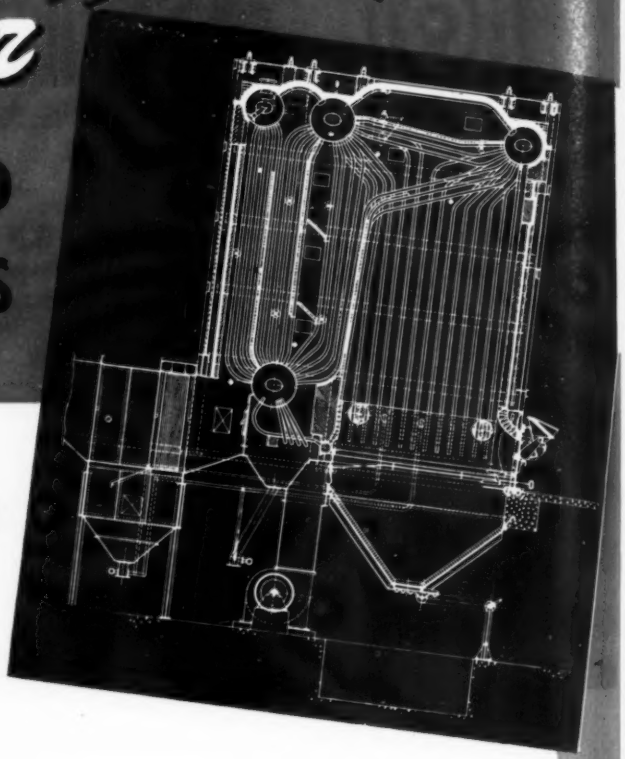
Y-types | Horizontal | Vertical | Radial | Portable | Gas Engine Compressors





Team-mates in Efficiency.... Low Cost Power

...BROS BOILERS AND SUPER-SPRED STOKERS



BROS 4-DRUM TYPE N WATER-TUBE BOILER made for Bros Super-Spred Stoker Firing

● This type of Bros water-tube boiler, complete with water cooled furnace is available in pressures up to 450 lb. design. Steam temperatures to 800° are obtainable by the addition of a two-stage Bros super-heater which keeps steam temperatures uniform at all ratings. Air preheaters permit use of air heated to 450°, thus assuring maximum efficiency. Dry steam is obtained over a wide range of operating conditions. Refractory maintenance is minimized by the water cooling of rear and side furnace walls.

Bros Boiler and Super-Spred Stokers are team-mates in the production of low cost power. Bros Super-Spred Stokers burn any kind and size of coal that will pass a 3 inch screen and burn it efficiently. Bros Super-Spred Stoker firing makes it possible to utilize the lowest cost coal locally available. Combustible factory waste can be burned in combination with coal at high efficiencies.

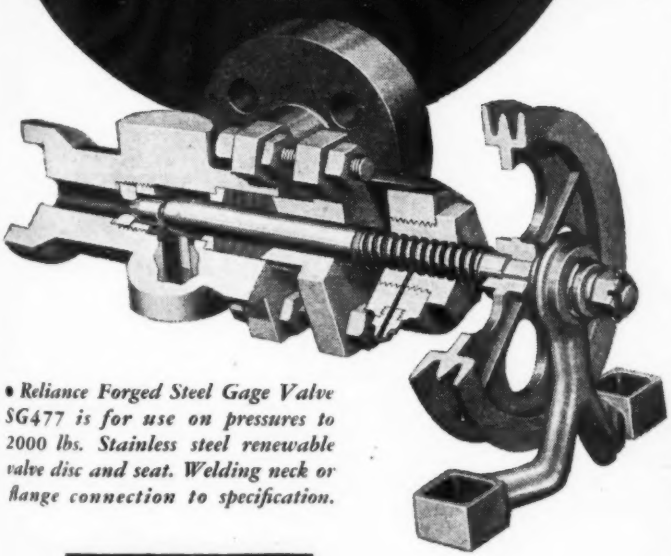
Bros representatives serve all markets. Write or wire for complete information. Bulletin No. 244 gives details on the Bros 4-Drum Type N Water Tube Boiler. This, or other literature on Bros boilers and spreader stokers will be sent to you.

WM. BROS BOILER & MFG. CO.
Minneapolis 14, Minnesota

BROS *Steam Generating* EQUIPMENT

Where Brute Strength pays in your boiler water level protection

Reliance Water Gage Equipment assures an extra margin of safety on any pressure



• *Reliance Forged Steel Gage Valve SG477 is for use on pressures to 2000 lbs. Stainless steel renewable valve disc and seat. Welding neck or flange connection to specification.*

RELIANCE SAFETY TEAM

SOUND CHECK ✓ ALARM Water Column

SIGHT CHECK ✓ EYE-HYE Remote Gage

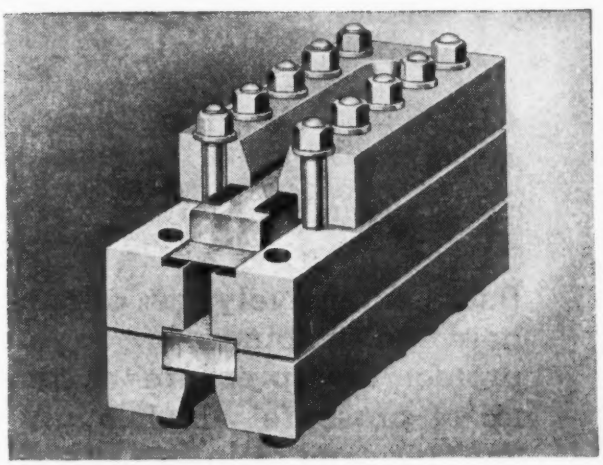
• *Reliance Mica-Protected Flat Glass Insert — simple, rugged construction. Resists warpage due to high temperature. Rapidly disassembled when necessary for cleaning or servicing.*

THERE'S no armor plate for water gages — even on a battleship. They must be able to *carry on,* regardless of abuse. Reliance Gage Equipment, correctly selected for the need, assures you unusual "safety-in-action" service.

The super-strong gage elements shown here — high pressure valve, and flat glass insert — are intended only for very high pressures. In designing and building such products Reliance has met the increasing steam pressures with new and sturdier designs . . . utilizing latest materials and manufacturing techniques. You profit by the built-in safety and long tough service.

Gage valves and inserts suitable for your pressure and installation style are available in approved Reliance designs that reflect our sixty years experience in making boiler safety devices exclusively. They're described in Catalog 415, sent for the asking.

THE RELIANCE GAUGE COLUMN COMPANY
5902 Carnegie Ave., Cleveland 3, Ohio



60 Years of Boiler Protection

BOILER SAFETY DEVICES since 1884

Reliance

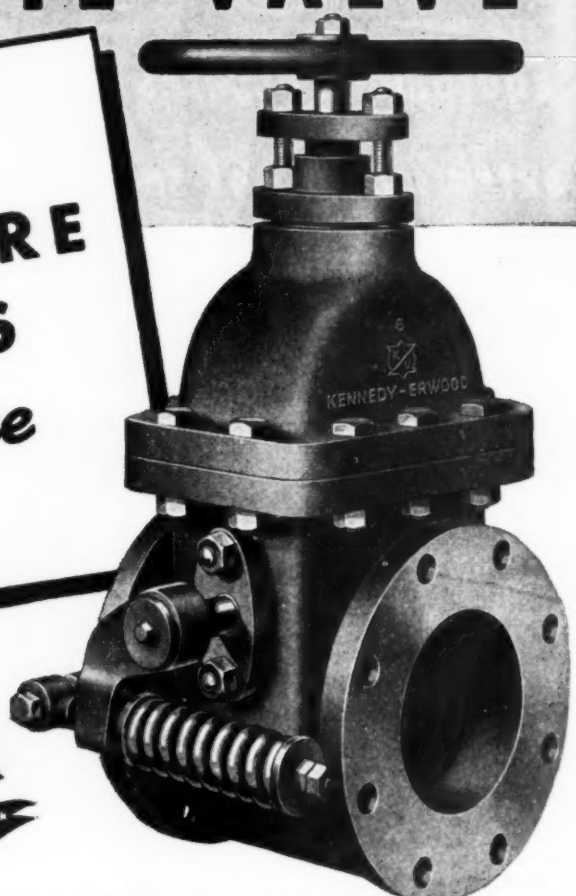
KENNEDY -ERWOOD

SWING GATE VALVE

Protects

LOW PRESSURE APPARATUS

from excessive pressure



Combines the functions of a gate valve, check valve and relief valve in a single unit.

Used extensively as a non-return valve on the exhaust line between turbines or engines and condensers or heaters to protect low pressure casings and cylinders against building up of pressure which might cause failure and severe damage to equipment or injury to operatives. Folder on request, explains other applications as a back pressure valve, atmospheric relief valve or safety valve on pumps, compressors, etc.

THE KENNEDY VALVE MFG. CO. • ELMIRA, N.Y.

Here is the true story of a large power plant that was caught between the horns of a dilemma . . . This plant operated on 100% make-up water, using about 5,000,000 pounds per day and employing no external treatment. Two sources of water were available—a natural pond and city water. Pond water was preferable because of the costs involved, but the pond was polluted with industrial wastes and whenever this water was fed to the boilers, severe carryover resulted. On the other hand, the city water was high in silica content and its use caused heavy silica scale and burned out tubes. The plant was truly between the devil and the deep blue sea!

W. H. & L. D. BETZ engineers were called in to find an economical solution to this perplexing problem. During the course of their studies test runs were made, employing the pond water together with a combination of foam-suppressing chemicals. This procedure proved to be both satisfactory and economical, and a complete system of plant control was quickly established. Under this control the plant is now operating on the low-cost pond water . . . and carryover has been eliminated.

This story is but one example of the many difficult water problems that are brought to W. H. & L. D. BETZ for solution. It illustrates the breadth of experience behind the Betz organization in keeping boilers "on the line".

CHEMICAL ENGINEERS AND CONSULTANTS ON ALL WATER PROBLEMS

W. H. & L. D. BETZ

FRANKFORD · PHILADELPHIA · PENNA.

COPPER ALLOY BULLETIN

MARINE AND POWER EDITION

REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

Prepared by Bridgeport Brass Company — "Bridgeport" BRASS CO. — *Headquarters for BRASS, BRONZE, and COPPER*

Clean Condenser Tubes Pay Big Dividends

Practical Suggestions for Maintaining High Vacuum

Operators naturally are anxious to obtain maximum efficiency from their power plants by maintaining as high a condenser vacuum as possible consistent with good engineering practice. More water at greater speeds is being used to condense steam faster and increase the efficiency of the turbine. High water velocity generally helps to keep the tubes clean. However, vast quantities of water rushing through the condenser increase the corrosion problem along certain lines. To counteract the corrosion accelerating effects of high water velocity, turbulence etc., Cuzinal, Duronze IV and Bridgeport's 70-30 Cupro Nickel are used in place of Admiralty.

The accumulation of films of slime and dirt, on the other hand, accelerate corrosion of condenser tube alloys by deposit attack and at the same time reduce heat transfer appreciably. These factors, of course, have a direct bearing on the successful operation of the entire power plant. Condensation of the steam is slowed up, and it becomes impossible to maintain the high vacuum necessary for greatest efficiency.

Slight Vacuum Increase Well Worthwhile

It is recognized by power plant engineers that a comparatively slight change in condenser vacuum of even 0.1 inch can make a difference of hundreds and even thousands of dollars per year, depending upon the size of the power plant involved.

How to Keep Tubes Clean

There are several methods of maintaining clean condenser tubes. Chlorine, chlorine and ammonia, or certain salts injected into the circulating water periodically or continuously have prevented certain slime conditions in connection with marine growths, and in some cases have made regular plug cleaning unnecessary. Chloramine solutions made by dissolving equal parts of bleaching powder and ammonium sulfate have been recommended where much chlorine is required to kill the accumulations of bacteria and algae.

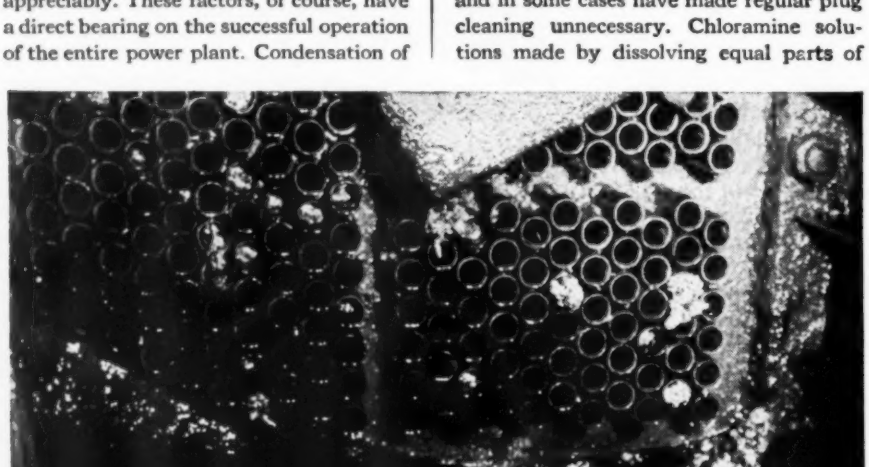
Tubes may also be cleaned regularly with high pressure air or water applied at the exit end and may be dried out for 24 hours by passing hot air at about 120° F. from the generator air ducts into the condenser, while steam at approximately 140° F. is slowly passed through the steam space and vented. When tubes are thoroughly dry, each one may be washed by a high pressure water jet. If it is possible to open the condenser for a sufficient time to kill the accumulated deposit of slime by drying out through normal air circulation, heat transfer properties may be restored without resorting to chemicals.

Additional Things You Can Do

Then, of course, there is the well known "plug" method which consists of pushing rubber plugs through the tubes. This is very effective if done regularly on schedule. Incidentally, wire brushes should never be used as they disturb the protective scale by abrasion.

Clean condenser tubes are desirable, not only from the standpoint of economy and operating efficiency, but also in the interests of conserving vital equipment. Listed below are some additional suggestions for keeping condensers free from dirt and debris and increasing their efficiency and life.

- Dredge channel and keep intake tunnel clean.
- Use screens fine enough to prevent debris from entering the condenser tubes.
- Check all valves, bonnets, and glands to prevent air from entering water stream.
- Use a device on water box, such as an air-venting system (air and erosion eliminator) for expelling entrained air.
- Clean out water box and keep the paint intact.
- Wire brush zinc protection plates and tighten bolts regularly in water box.



Slime accumulation on tubes and in water box of condenser using semi-tropical sea water.

Note: Bridgeport products are supplied in accordance with existing priority regulations.

BRIDGEPORT BRASS

BRIDGEPORT BRASS COMPANY, BRIDGEPORT 2, CONN.

ARMY E NAVY

ESTABLISHED 1865

For a Refractory that Lasts Longer

CRYSTOLON BRICK

by NORTON

Time is the fundamental measure of a practical refractory.

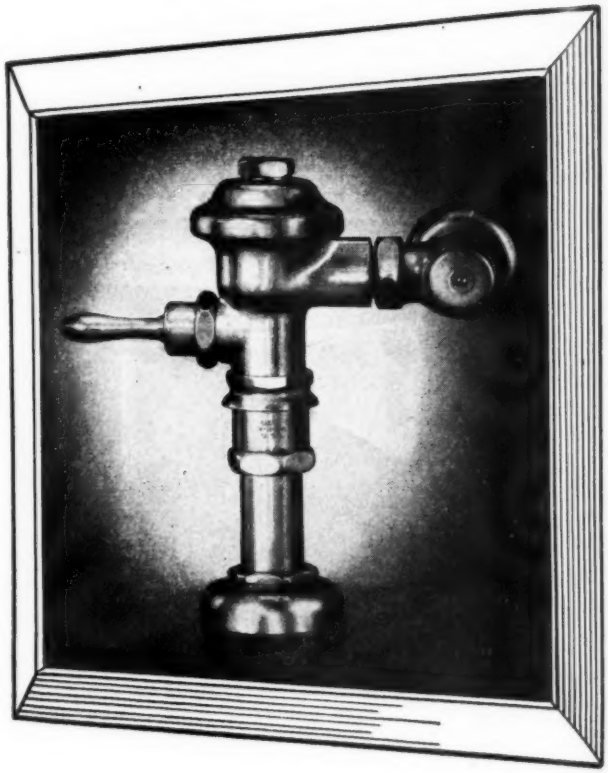
Long life is the practical result of using CRYSTOLON (silicon carbide) brick.

That is the reason for the ever increasing use of CRYSTOLON brick in stoker-fired furnaces, generators of water gas sets, and combustion chambers of high temperature furnaces.

We will gladly provide you with the technical reasons why CRYSTOLON (silicon carbide) brick give extraordinarily long life under the severest operating conditions.

NORTON COMPANY WORCESTER 6, MASSACHUSETTS

Sloan Flush Valves Postwar?



The Picture in Brief Is This–

The ROYAL, NAVAL and STAR Flush Valves, made famous by Sloan for over a third of a century, will again be manufactured just as soon as critical materials are released.

These Flush Valves, greatly improved in workmanship and in engineering design, will be even better than Flush Valves of prewar days. Experience gained in the manufacture of war matériel (mass production machining to micro-tolerances) has contributed much to our precision methods. Moreover, engineering improvements effected through laboratory research during the war will mean new and exclusive features obtainable only in Sloan Flush Valves.

Therefore, with the above information—and with reference to Sloan's No. 40 catalog for roughing-in guidance, you can *plan now* to use Sloan Flush Valves in your postwar building.

When ordering Flush Valves specify SLOAN—the acknowledged leader by which all other flush valves are judged. Remember—*there are more Sloan Flush Valves sold than all other makes combined.*

* * *

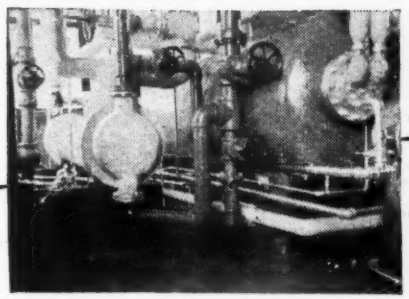
NOTE: SLOAN *BRASS* FLUSH VALVES ARE NOW AVAILABLE FOR USE IN CHEMICAL AND RESEARCH LABORATORIES, ABATTOIRS, FOOD PACKING AND PROCESSING PLANTS, HOSPITALS (INCLUDING ALL BUILDINGS IN HOSPITAL GROUPS), CLINICS AND DISPENSARIES. ACCORDING TO LIMITATION ORDER L-42, SCHEDULE V, AS AMENDED SEPTEMBER 9, 1944.

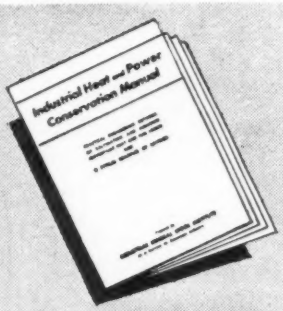
SLOAN VALVE COMPANY, 4300 West Lake Street, CHICAGO

CASE No. 6

Problem—To increase efficiency of FEED WATER HEATER
Material—1½ inch blanket of Mineral Wool Insulation
Result—In one year you can

SAVE 3769 gallons of oil!





FREE

Heat & Power Conservation Manual tells how you can Save Fuel in your plant

Send for your copy of our new Heat and Power Conservation Manual today. It gives the latest practical engineering methods for getting more heat and power out of your present equipment . . . tells you how to save fuel . . . outlines an accurate method of computing the savings . . . presents case studies that show the great savings that can be made. Write for this FREE book today.

To step up the efficiency of your equipment insulate against heat losses today—insulate with Mineral Wool. No other material does so much for so little. Its extraordinary low thermal conductivity will make your equipment deliver more power with less fuel.

Mineral Wool is easy to apply. It is light in weight. Comes in six convenient forms. Fits easily in irregular places. It is a non-critical material—always available.

Cooperate with your government's drive to save critical fuel. Stop heat losses now. *Send for this new Free manual today.* Industrial Mineral Wool Institute, 441 Lexington Avenue, New York 17, N. Y. Dept. P11.

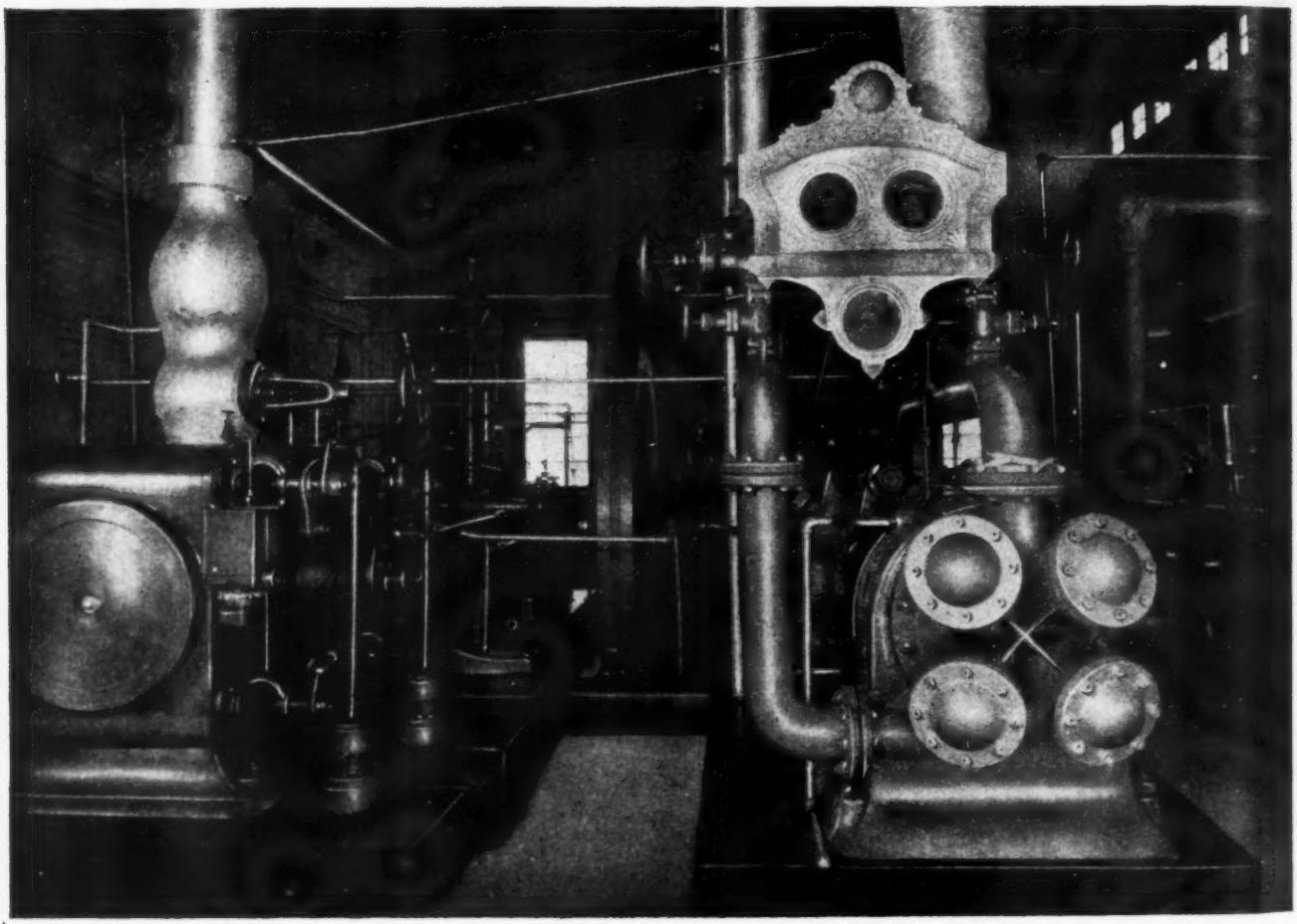
☆ ☆ ☆

Mineral Wool Insulation is also effective for controlling cold temperatures and is an excellent fire-retarder.

IF IT'S TOO HOT TO TOUCH
IT NEEDS INSULATION

MINERAL WOOL INSULATION PRODUCTS
for high and low temperatures
BLANKETS · FELTS · BLOCKS · CEMENTS · PIPE COVERINGS · FILL MATERIALS

BETTER *Lubrication* Means Better Maintenance



Is difficult maintenance a problem? Maybe excessive wear due to inefficient lubrication is the cause. That's where Sinclair STEAM CYLINDER and VALVE OILS can help.

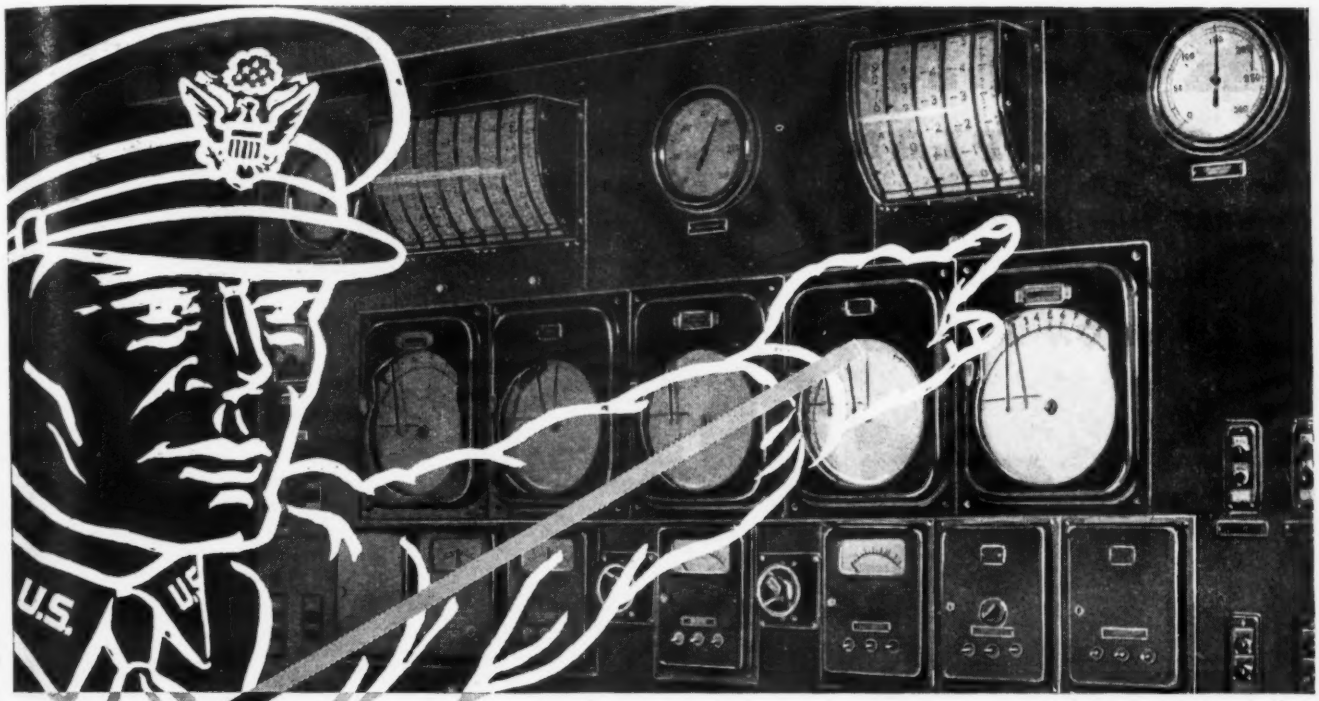
These oils have a long record of perfect performance in heavily loaded installations . . . correctly meet all requirements of power house operation . . . are exactly suited to the design and operating characteristics of all types of engines.

• • •

(Write for "The Service Factor"—published periodically and devoted to the solution of lubricating problems.)

SINCLAIR INDUSTRIAL OILS

FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE SINCLAIR REFINING COMPANY, 630 FIFTH AVENUE, NEW YORK 20, N. Y.



USE THIS WINNING STRATEGY ON YOUR BOILER PLANT

Fuel-Saving Starts With CONTROL

THOSE perpetual foes of combustion efficiency—Excess Air, Fuel waste, High Operating Cost—haven't a chance against the strategy of Hays Automatic Combustion Control.

There's no guessing here, nothing left to chance. Your Hays Control System assembles *all* the data concerning combustion, measures all variable elements, and *regulates* them—automatically. It does that job better than man-power can do it—never absent, never overworked, never an unwary instant: smooth, faultless, *tireless* efficiency 24 hours every day.

Hays Combustion Control's greater service today is in putting youthful efficiency back into wasteful steam plants—making them *better* plants, safer plants, lower cost plants.

Smart strategy?—it never misses. The Hays Combustion Control Catalog explains how you can use it. Full of helpful steam-power data. Write for it today.

THE MODERN SYSTEM *It's Electrical*

HAYS *Automatic* COMBUSTION CONTROL

THE HAYS CORPORATION • MICHIGAN CITY, IND.

"ROVING" POWER PLANT

USES DEPENDABLE BADGER CORRUGATED EXPANSION JOINTS

This mobile power plant is one of thirty-four built and being built by Westinghouse for following Allied Armed Forces and quickly restoring electric light and power in war-stricken communities. Although developed to meet a wartime need, the power train can also perform similar useful services in peacetime—as, bringing emergency electricity to cities whose normal power supply may have been cut off by floods or other disasters.

TWISTING around curves and bumping over switches, frogs, cross-overs and sagging rails, this power-plant-on-wheels presents one of the severest tests for a pipe expansion joint; while wide temperature ranges add a further form of punishment.

Badger Corrugated Expansion Joints, with their exclusive Badger feature of ALL-CURVE corrugations, were chosen for the steam pipes running between the boiler cars and the turbo-generator car. They were chosen because they provide dependable safeguards against lateral and longitudinal movements; and against vibration, no matter how severe or incessant.

• • •

The Badger Corrugated Expansion Joint is formed from a single piece of tubing—by a special Badger process that reduces forming stresses to the minimum. This, plus the ALL-CURVE contour of each corrugation, assures high uniformity in the distribution of flexing stresses. There are no straight sides, angles, "junctions" or "pockets" to develop localized weak spots.

•

PACKLESS, too. One-piece construction also eliminates the need of packing—and consequently the need of packing maintenance. Because of this the heavy expense of manhole construction can usually be saved as well when installation is underground.

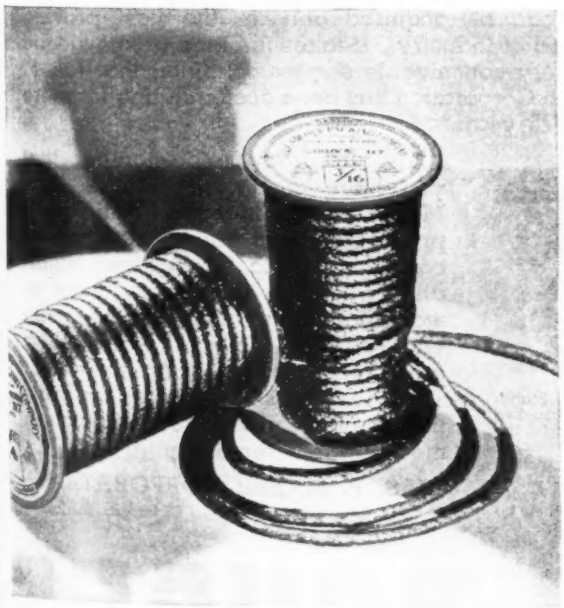
Made in Copper for normal pressures and temperatures; and in Stainless Steel where corrosion is a problem. Single and multiple corrugations—for traverses ranging from a fraction of an inch upward. Also made in *self-equalizing* type for uses that require the added protection of equalizing rings. *FREE BULLETIN No. 200 (on self-equalizing type ask for Bulletin No. 100).*

E. B. BADGER & SONS CO., 75 PITTS ST., BOSTON 14, MASS.

Agents in Principal Cities

Badger PACKLESS CORRUGATED EXPANSION JOINTS

IF IT'S **BADGER**-MADE IT'S **GOT SOMETHING!**



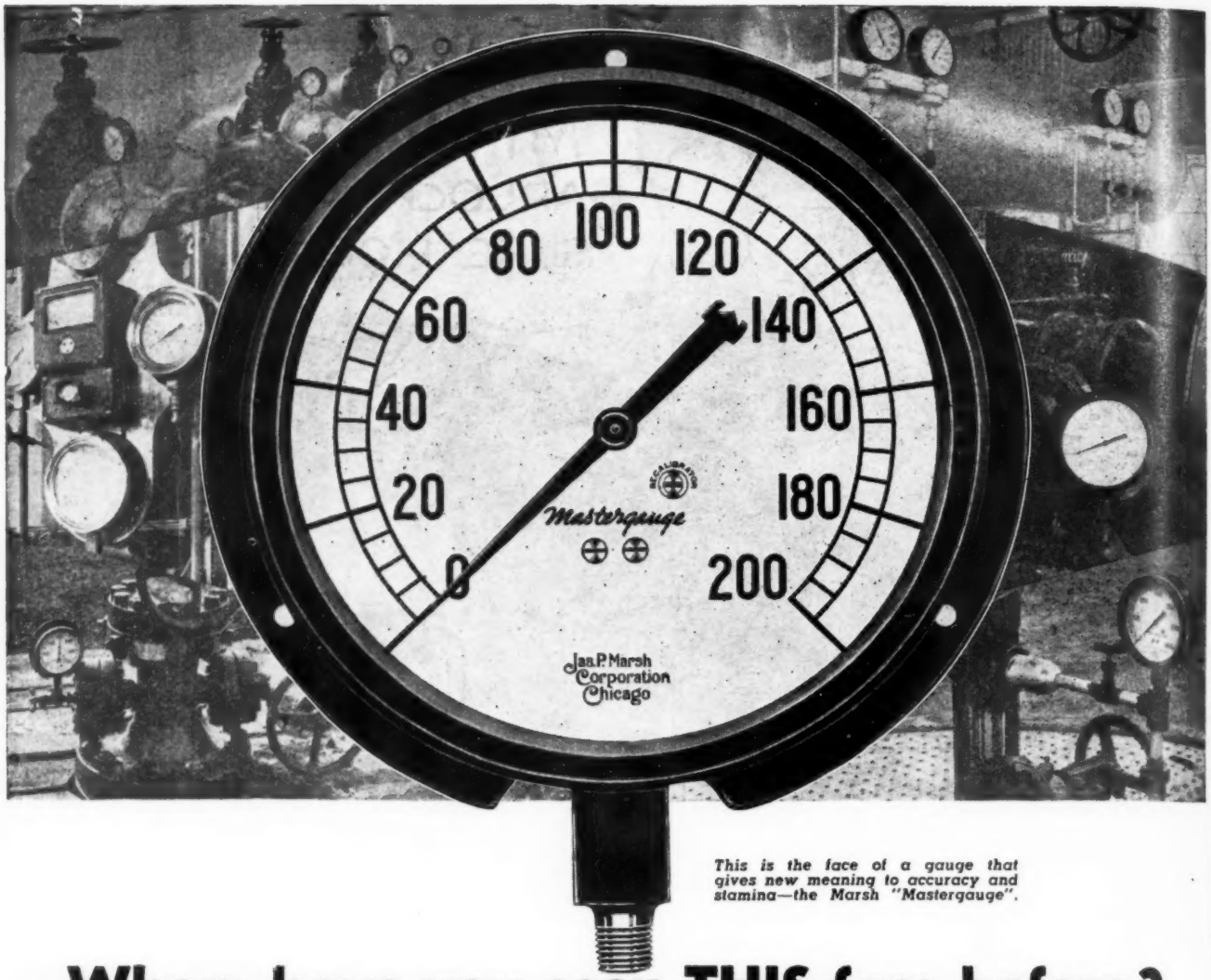
GARLOCK 117 globe and angle valve stem packing is equally effective against high pressure steam, hot or cold water, or oil. Furnished either braided or twisted in all sizes from 1/16" to 3/4".

"They Sure Hold Up!"

GARLOCK Packings may not last several generations—but they do give much longer service than ordinary packings, because they are produced in our own plant and are *quality-controlled* from raw material to finished product.

The Garlock Packing Company, Palmyra, N.Y.
In Canada: The Garlock Packing Company of Canada Ltd. Montreal, Que.

Garlock



This is the face of a gauge that gives new meaning to accuracy and stamina—the Marsh "Mastergauge".

Where have you seen THIS face before?

IT'S a familiar face—the honest face of a good instrument. You have looked at it on boilers, compressors, tanks — innumerable places where proper, safe operation depends on accurate pressure indication. It was chosen in many cases by manufacturers who knew that the success of their products rested in no small part on the truthfulness of its pressure or vacuum indication.

Often that face is the face of a veteran—a gauge that has been at it a long time, operating under tough conditions. But as you trace back over the Marsh Gauges you have known, can you recall a single one of them that has ever failed to do its job right?

To build such a gauge requires more than good design and construction. It takes a great fund of practical knowledge to guide that design—knowledge that can be acquired only in the vast proving ground of industry. It takes the kind of knowledge of every conceivable service condition that Jas. P. Marsh Corporation has been accumulating for more than 75 years.

The Gauge with the "RECALIBRATOR"

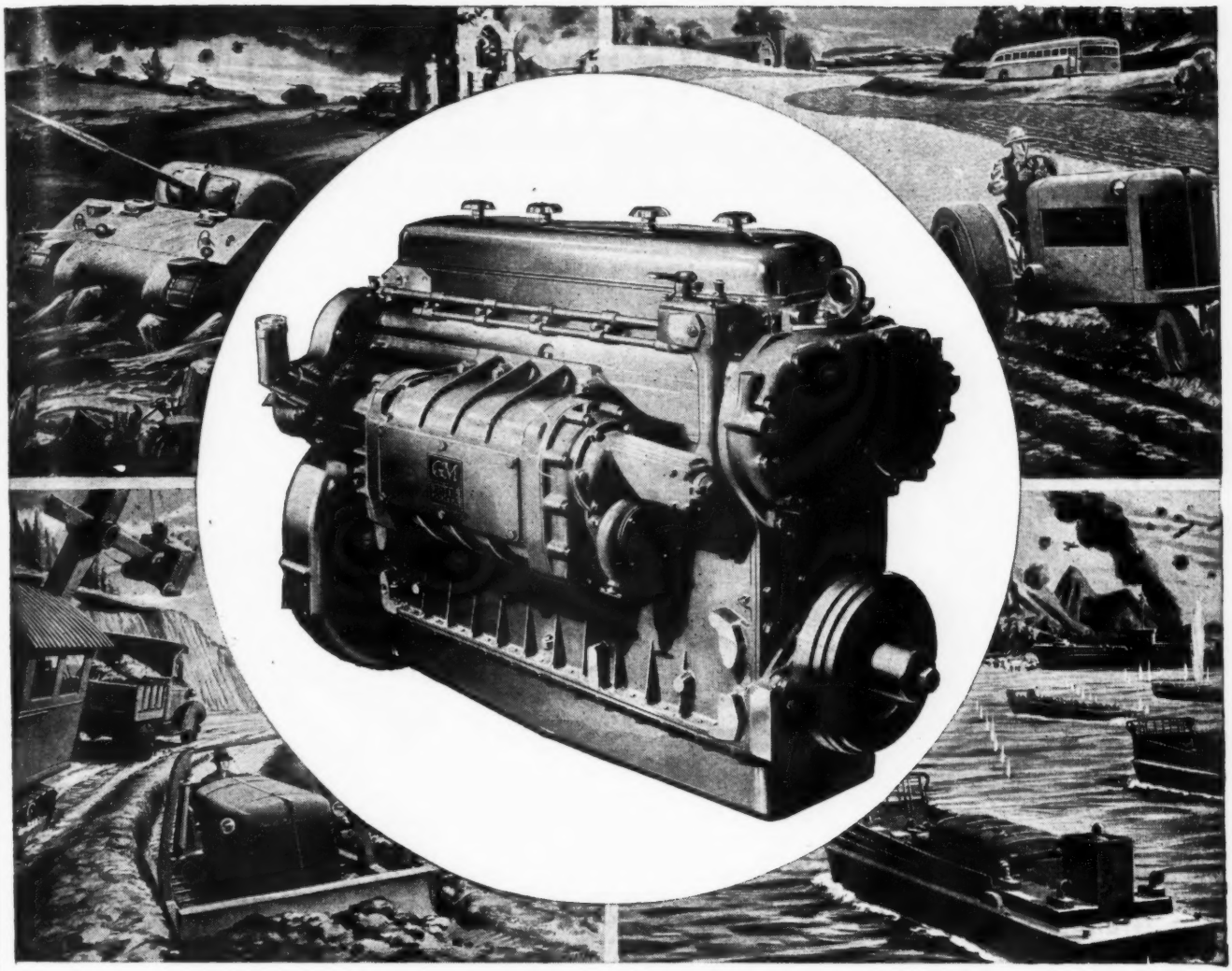
A gauge built to Marsh Standards is not likely to be knocked out of adjustment. But if it is, the Marsh "Recalibrator" will quickly restore its accuracy. Simply turn the "Recalibrator" screw until the pointer is at zero when not under pressure. The gauge will then be right at all points on the dial. Unlike other methods of re-setting, the "Recalibrator" gets at the root of the error — re-establishes the relation of the bourdon tube to the movement — actually *re-calibrates* the gauge.

The accuracy and stamina that you have come to associate with Marsh Gauges is found in all Marsh products — Dial Thermometers, Recorders, Heating Specialties. Naturally, when U. S. Industry went to war, Marsh Instruments were given vital assignments for which their great record so well qualifies them. There is a Marsh Instrument for practically every pressure or temperature measurement requirement.

JAS. P. MARSH CORPORATION
2075 Southport Avenue, Chicago, Illinois

MARSH GAUGES

DIAL THERMOMETERS ★ RECORDERS ★ HEATING SPECIALTIES



GM DIESELS SERVE WHEREVER AMERICA NEEDS POWER

America's fighting Engineers and Seabees really work miracles. Sand dunes are leveled. Jungles are cleared. Landing strips appear overnight. Staggering loads are moved over land and sea.

Helping them work these miracles are General Motors Diesel engines.

Because these engines are rugged and dependable, they get the toughest kinds of jobs to do.

Because they take so little fuel, they save precious transport space.

Because they have been designed for simplest maintenance, they stay on the job and keep on the go.

War is a tough proving ground for engines. It shows their mettle, reveals their stamina. As they perform their wartime tasks, these GM Diesels are proving the service they will continue to render in the many civilian needs for dependable, economical power after the war.

The Army-Navy "E" for efficiency in war production flies proudly over the GM Diesel plant in Detroit.

KEEP AMERICA STRONG
BUY WAR BONDS

GM
GENERAL MOTORS
DIESEL POWER

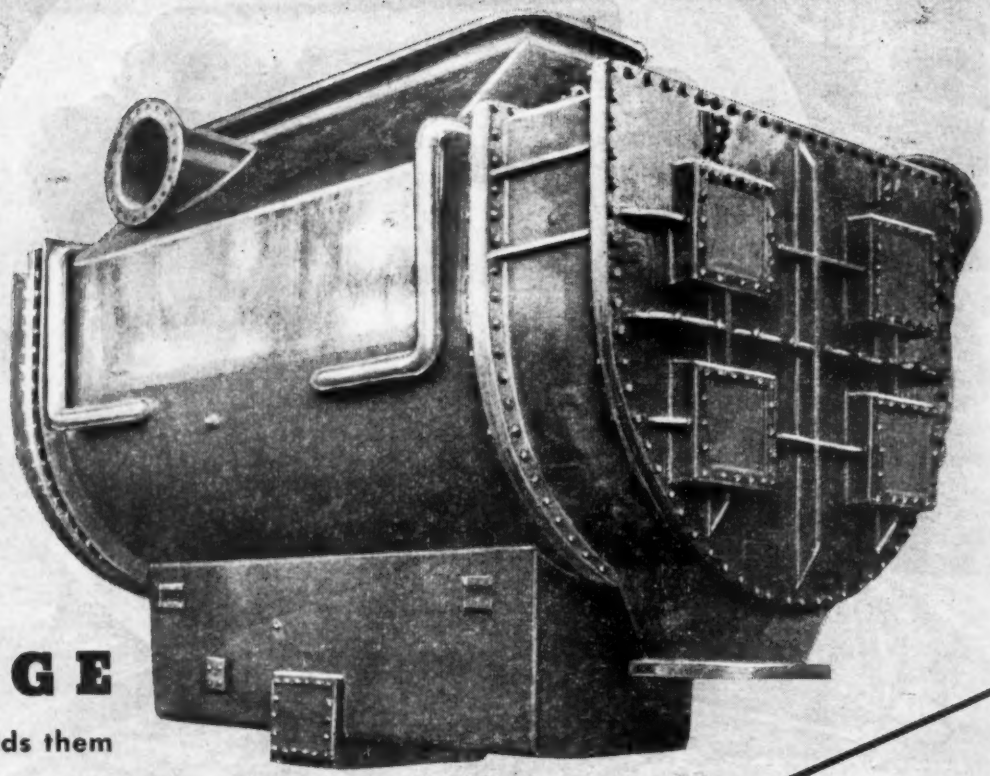
ENGINES . . 15 to 250 H. P. . . **DETROIT DIESEL ENGINE DIVISION,** Detroit 23, Mich.

ENGINES . . 150 to 2000 H. P. . . CLEVELAND DIESEL ENGINE DIVISION, Cleveland 11, Ohio

LOCOMOTIVES . . . . . ELECTRO-MOTIVE DIVISION, La Grange, Ill.

HEAT TRANSFER EQUIPMENT

CONDENSERS • STEAM EJECTORS • EVAPORATORS • HEAT EXCHANGERS

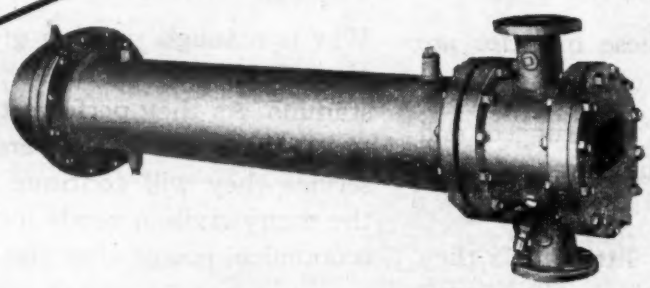


LARGE

Graham builds them big! Ten, twenty, thirty, fifty thousand square foot condensers are all made to order in our Oswego works.

SMALL

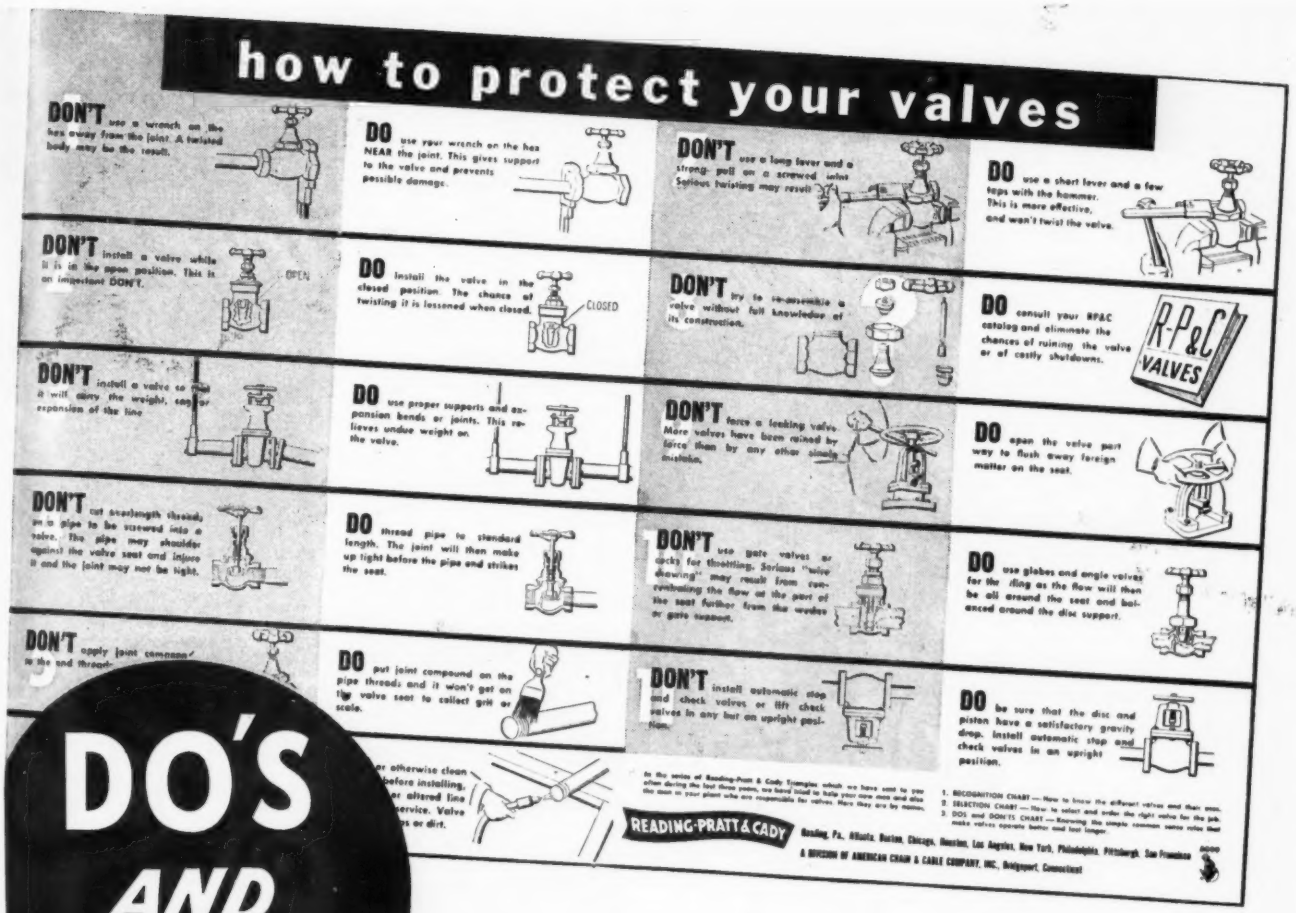
No unit is too small for painstaking Graham craftsmanship. Our Batavia plant is experienced in this work.



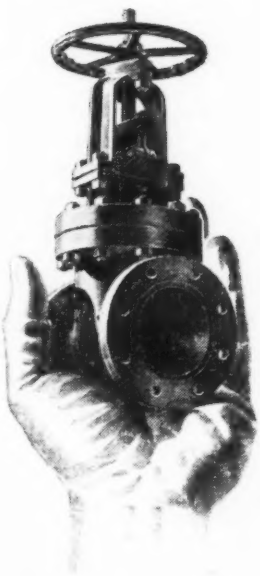
AWARDED THE MARITIME "M" PENNANT AND VICTORY FLEET FLAG APRIL 8, 1944

GRAHAM MANUFACTURING CO., INC.

415 LEXINGTON AVENUE • NEW YORK 17, N. Y.


how to protect your valves
DON'T use a wrench on the hex away from the joint. A twisted body may be the result.
DO use your wrench on the hex NEAR the joint. This gives support to the valve and prevents possible damage.
DON'T use a long lever and a strong pull on a screwed valve. Serious twisting may result.
DO use a short lever and a few taps with the hammer. This is more effective, and won't twist the valve.
DON'T install a valve while it is in the open position. This is an important DON'T.
OPEN
DO install the valve in the closed position. The chance of twisting it is lessened when closed.
CLOSED
DON'T try to re-assemble a valve without full knowledge of its construction.
DO consult your RP&C catalog and eliminate the chances of ruining the valve or of costly shutdowns.
R-P&C VALVES
DON'T install a valve so that it will carry the weight, cause expansion of the line
DO use proper supports and expansion bends or joints. This relieves undue weight on the valve.
DON'T force a leaking valve. More valves have been ruined by force than by any other single mistake.
DO open the valve part way to flush away foreign matter on the seat.
DON'T cut overlength threads on a pipe to be screwed into a valve. The pipe may shoulder against the valve seat and injure it and the joint may not be tight.
DO thread pipe to standard length. The joint will then make up tight before the pipe end strikes the seat.
DON'T use gate valves or cocks for throttling. Serious "valve chewing" may result from concentrating the flow at the part of the seat further from the wedge or gate support.
DO use globes and angle valves for the throttling as the flow will then be all around the seat and balanced around the disc support.
DON'T apply joint compound to the end thread
DO put joint compound on the pipe threads and it won't get on the valve seat to collect grit or scale.
DON'T install automatic stop and check valves or lift check valves in any but an upright position.
DO be sure that the disc and piston have a satisfactory gravity drop. Install automatic stop and check valves in an upright position.
or otherwise clean before installing, altered line service. Valve or dirt.
In the series of Reading-Pratt & Cady Examples which we have sent to you often during the last three years, we have tried to help your new men and also the men in your plant who are responsible for valves. Here they are by names:
1. RECOGNITION CHART — How to know the different valves and their uses.
2. SELECTION CHART — How to select and order the right valve for the job.
3. DOS and DON'TS CHART — Knowing the simple common sense rules that make valves operate better and last longer.
READING-PRATT & CADY
Reading, Pa., Atlanta, Boston, Chicago, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, San Francisco
A DIVISION OF AMERICAN CHAIN & CABLE COMPANY, INC., Bridgeport, Connecticut
ACCO

DO'S AND DON'TS ...TO MAKE YOUR VALVES SERVE YOU *BETTER-LONGER*



This is the third of the series of charts developed by Reading-Pratt & Cady as a service to the valve users of the nation. Like the other two—How To Know Valves and How To Select Valves—this one, How To Protect Your Valves, will serve as a reminder to experienced men and as invaluable information to new men in industry. It tells in pictures and simple, non-technical language how to avoid the mistakes that shorten the life of valves—how to get maximum service from them.

For copies of this chart, address our offices in Reading, Pennsylvania. There's no charge, of course.

READING-PRATT & CADY

MANUFACTURERS OF

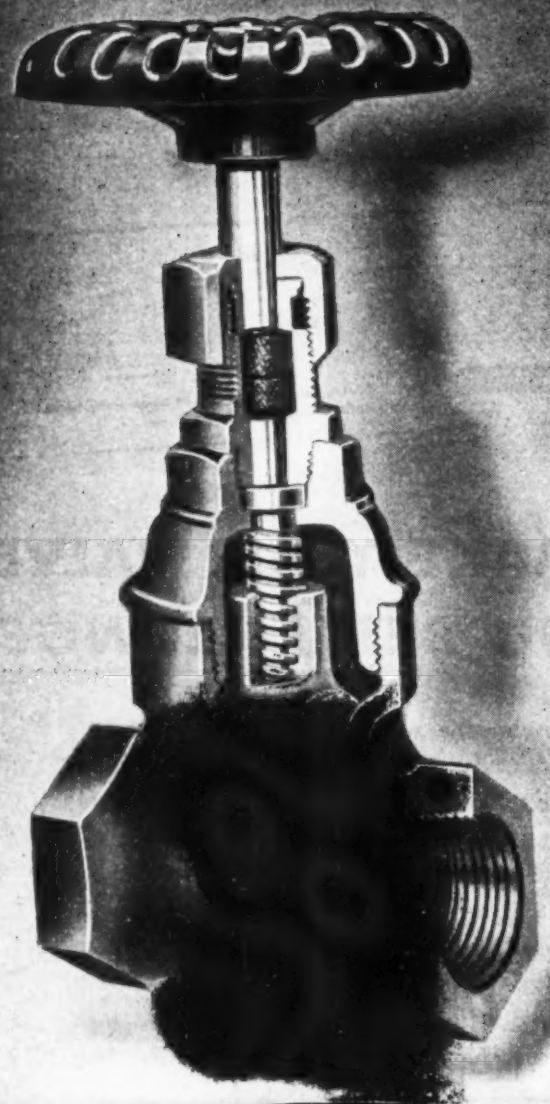
READING CAST STEEL VALVES AND FITTINGS • PRATT & CADY BRASS AND IRON VALVES
D'ESTE VALVE AND ENGINEERING SPECIALTIES

Reading, Pa., Atlanta, Boston, Chicago, Denver, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, San Francisco

ACCO

A DIVISION OF AMERICAN CHAIN & CABLE COMPANY, Inc., BRIDGEPORT • CONNECTICUT

Fairbanks Valves



Fairbanks Bronze Gate Valves are designed so that the wedge is entirely removed from the line of flow when fully open. They can be repacked under pressure when wide open.

Fairbanks Valves can be depended on for the maximum in years of useful, carefree service.

Made in non-rising and rising stem types for practically every application; also with outside screw and yoke. Available with screwed or flanged ends for steam working pressures of 125 to 300 lbs.

Write for Catalog No. 42 and name of our nearest distributor.

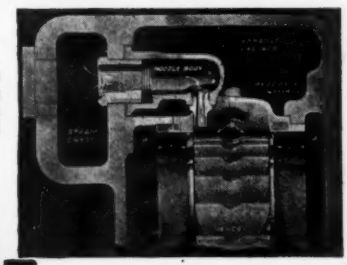
THE FAIRBANKS COMPANY

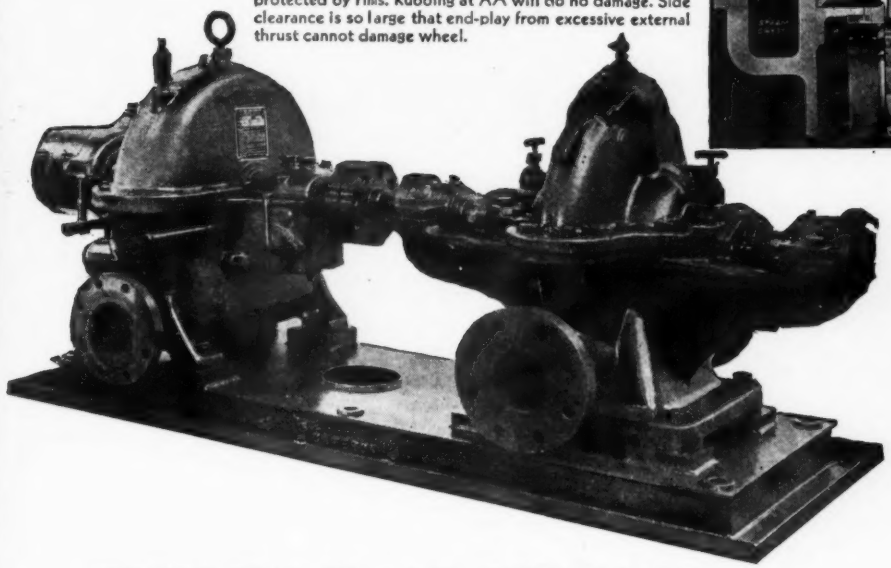
393 Lafayette St., New York 3, N.Y.
520 Atlantic Ave., Boston 10, Mass.
15 Ferry Street, Pittsburgh 22, Pa.

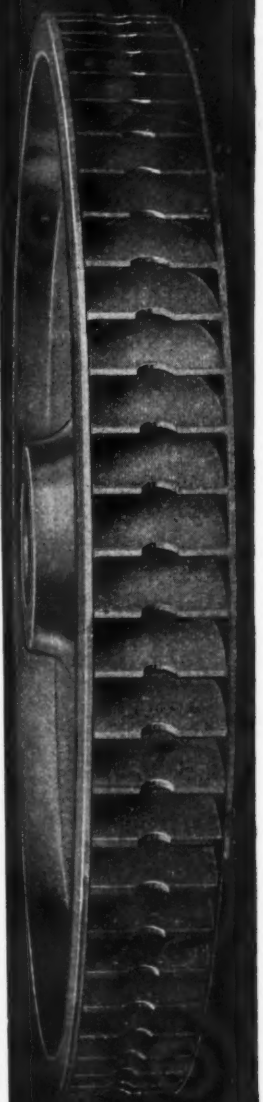
TERRY

DIAGRAM SHOWING WHEEL CLEARANCES

AA—Rim clearance, B—Large blade clearance, CC—Side clearance, (about one inch). Blades cannot foul, as they are protected by rims. Rubbing at AA will do no damage. Side clearance is so large that end-play from excessive external thrust cannot damage wheel.







GENEROUS BLADE CLEARANCES INCREASE TERRY TURBINE DEPENDABILITY

In the Terry Wheel Turbine fine blade clearance is not essential to high operating efficiency. The actual clearance between the moving and stationary blades is greater than ⅛ inch. End play cannot affect this clearance and the side clearance is one inch or more. It is therefore not essential to make frequent adjustments of the thrust to maintain efficient and safe operation.

Clearance in the Terry blading may be reduced only by excessive wear of the main bearings, but even if this should occur, the projecting rims on the side of the wheel would rub on the smooth protecting surfaces of the reversing chamber, thereby automatically stopping the turbine before damage could result. Replacement of the interchangeable bearings immediately restores the original clearance.

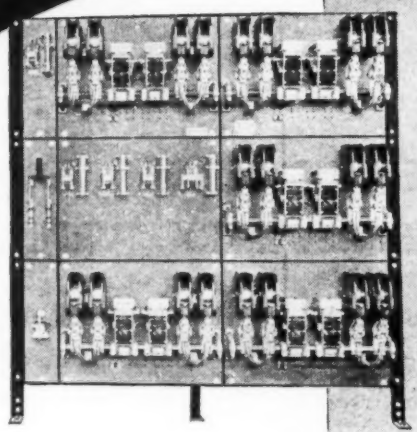
Details of this durable turbine are discussed in Bulletin S-116.
A request on your business letterhead will bring a copy.

T-1155

THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD, CONN.

SERVES 18-INCH,
5-STAND BAR MILL
AT JESSOP STEEL CO.
WASHINGTON, PA.

EC&M 2300 VOLT WOUND-ROTOR *Motor* CONTROLLER



For 2300 volt, wound-rotor motors, EC&M Non-reversing or Reversing Control is without equal. And for the primary, high voltage switching requirements, Type ZHS Magnetic Contactors are used.

• These contactors are of compact design and oil-immersed, with the control circuit potential transformer, in a single shock-proof enclosure. For reversing applications, as used on this 18-inch mill, two contactors are mounted back-to-back with heavy, mechanical interlock-bar between them and enclosed under oil in one tank.

Panels for controlling the secondary, or rotor, circuit consist of *LINE-ARC* Contactors and Frequency Acceleration Relays. Type NX Master Switch gives speed control.

Specifications of these EC&M Wound-rotor Motor Controllers are given in Bulletins 1062-C, 1140-B, and 1182-2. Write for your copies.

OUTSTANDING FEATURES of EC&M 2300 Volt Magnetic CONTACTOR CONTROL

1 *Heavy-duty, mill type, 2300 volt contactors—mounted under oil in one enclosure with positive interlocks for separating the circuits.*

2 *LINE-ARC magnetic contactors for control of secondary circuits have low upkeep cost, high arc-rupturing ability.*

3 *FREQUENCY RELAYS govern rate of acceleration automatically—respond accurately to motor speed, increasing motor torque as required.*

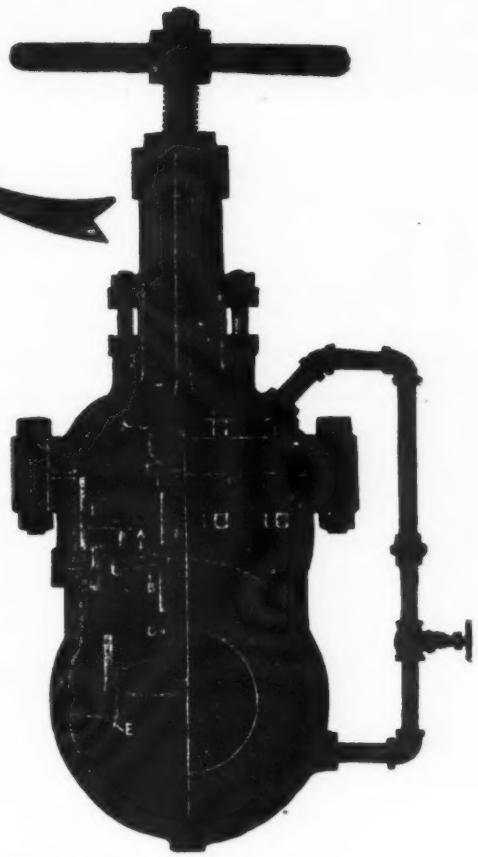
4 *Potential transformer, self-contained in contactor enclosure, supplies 220 volts for control circuit.*

THE ELECTRIC CONTROLLER & MFG. CO.

2698 EAST 79th STREET • CLEVELAND 4, OHIO

Here is Automatic Protection Against Runaway Turbines

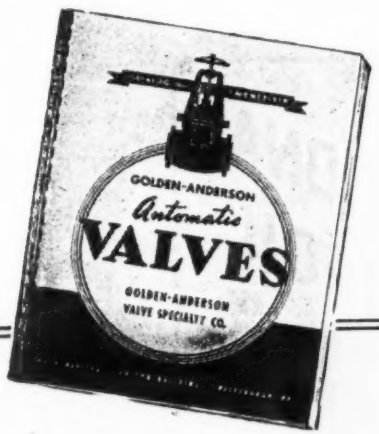
It's the GAVSCO EMERGENCY STOP VALVE



This Throttle and Emergency Stop Valve Works instantly and automatically . . . prevents any unit from exceeding safe operating speed. It's value to you lies in the fact that it permits the location of trouble *before* damage occurs.

GAVSCO Emergency Stop Valves are supplied in Angle and Globe patterns, in sizes from 2½" to 16". Valve trim may be Bronze, Monel, Stainless Steel or Gallavoy, according to pressure and temperature conditions. Seat rings and disc may be Stellited.

Write today for this catalog . . . describes and illustrates the complete line of GAVSCO Specialty Valves.

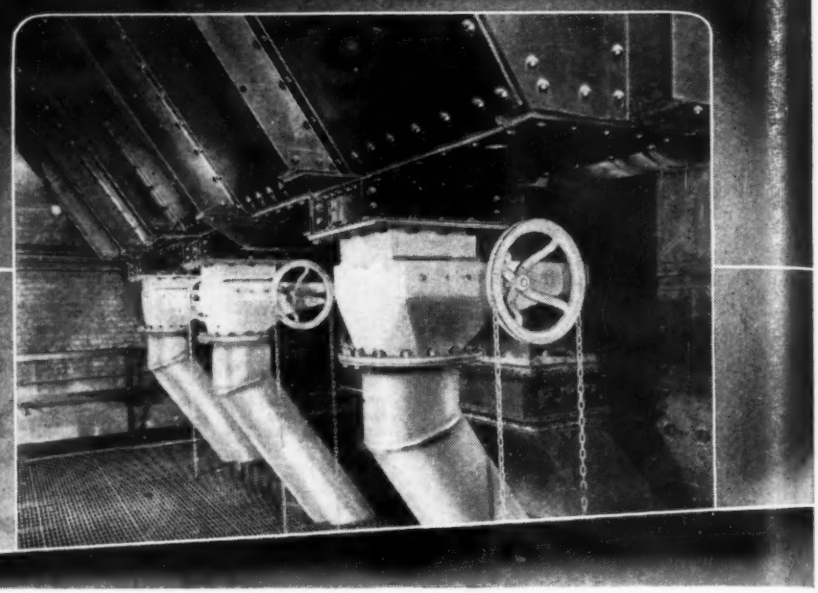


GOLDEN-ANDERSON VALVE SPECIALTY CO.

FULTON BLDG., PITTSBURGH, PA.

Manufacturers of Special Valves for Special Services

What good is a Coal Valve that sticks?



Coal Valves are often left in one position for many days . . . sometimes weeks and months. Moisture and sulfur, always present in coal, cause deterioration of valve parts to a point where operation of the valve is difficult —and sometimes impossible. S. E. Co. Valves are designed and constructed so as to eliminate this common problem. They operate easily *at all times*, whether they are in constant operation or merely stand-by use. If you want a Coal Valve that *works* ask S. E. Co. Write today . . . address inquiries to STOCK ENGINEERING COMPANY, 715 Hanna Building, Cleveland 15, Ohio.

STOCK

★ ENGINEERING CO. ★

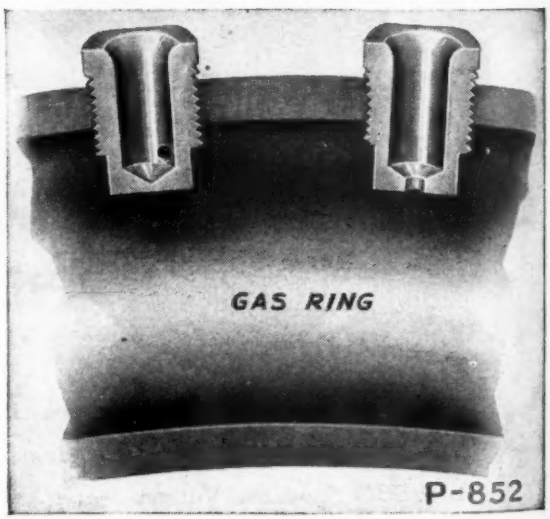
CONICAL Non-Segregating Coal Distributors **S.E.Co. Coal Valves and Coal Scales**

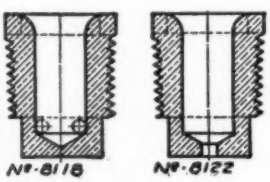
Distinctive Design Features of NATIONAL AIROIL GAS TIPS

provide many operating advantages

The National Airoil patented* design Gas Tip is a decided improvement over the conventional type gas tip for cylindrical, ring gas burners, as well as pipe gas burners.

This gas tip, as can be seen in the illustration, has the orifice immersed in the gas chamber so that the orifice is protected from overheating, oxidizing and coking by the cooler gas in the ring. Also, the gas orifice being located in the cup, is screened from most of the radiant heat of the furnace. Because of these features, the gas tips are practically free from clogging or deterioration, even after a long period of continuous operation.





National Airoil Gas Tips are furnished in ¼" and ⅜" pipe size, and are made as standard in carbon steel and special in ceramic materials.

*U.S. Patent #2,160,615

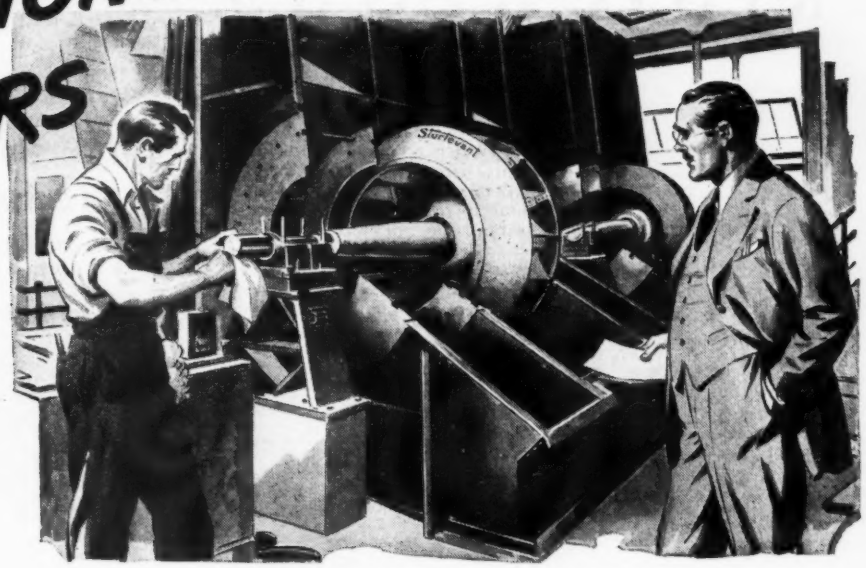
NATIONAL AIROIL FUEL OIL - GAS BURNERS

NATIONAL AIROIL BURNER Company, Incorporated

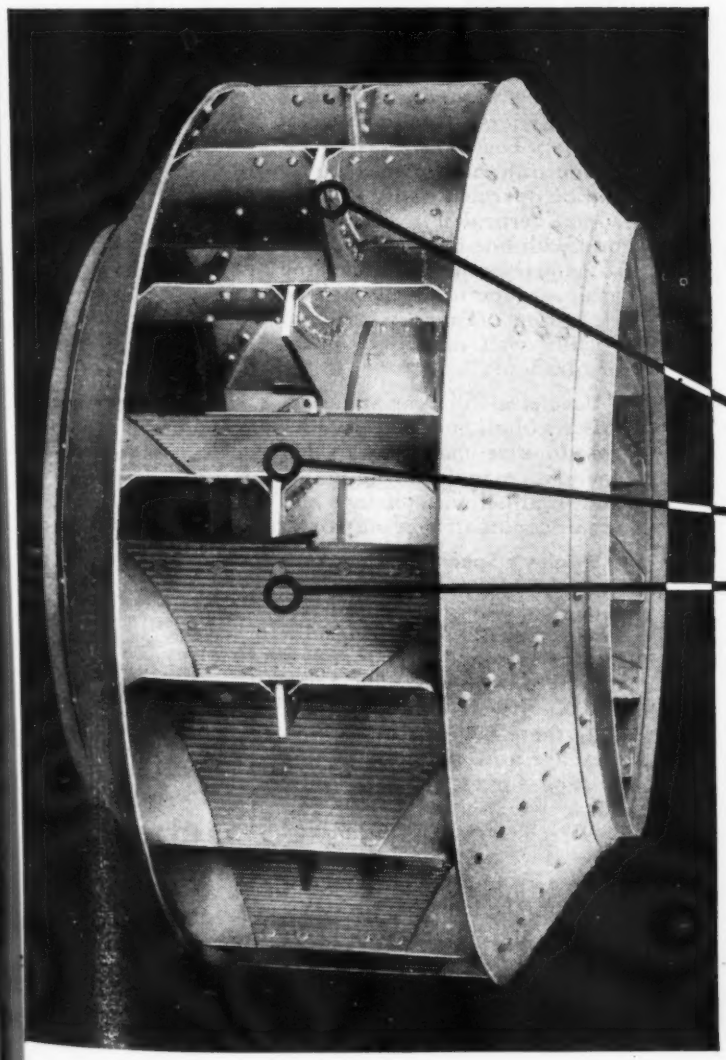
1250 EAST SEDGLEY AVENUE, PHILADELPHIA 34, PENNA.

OIL BURNERS • GAS BURNERS • GAS PILOTS • PUMP SETS • EXPLOSION DOORS
ACCESS DOORS • AIR DOORS • BURNER BLOCKS • FURNACE OBSERVATION WINDOWS

STRETCH MONTHS INTO YEARS



...by using STURTEVANT EROSION RESISTING WHEELS!



Induced draft fan wheels in some plants must be replaced all too frequently. Fly ash, eroding the blades and centerplate, often limits efficient life to a matter of *months*. That's why Sturtevant designed this special Erosion Resisting Wheel. Centerplate and tie rods are eliminated. Each wheel requires only 32 to 48 blades—shaped to minimize abrasive action and *armored* against it!

The result:—In outstanding plants, Sturtevant Erosion Resisting Wheels show little sign of wear—no loss in efficiency—*after two and three years* service under severe fly ash conditions; longer where the conditions are not so severe. Here are the reasons:—

1. Center support is cut away between blades, permitting streams of concentrated ash to meet—and dissipate their abrasive action on each other.

2. Blades being continuous—without a dividing centerplate—offer no obstruction to the smooth flow of fly-ash.

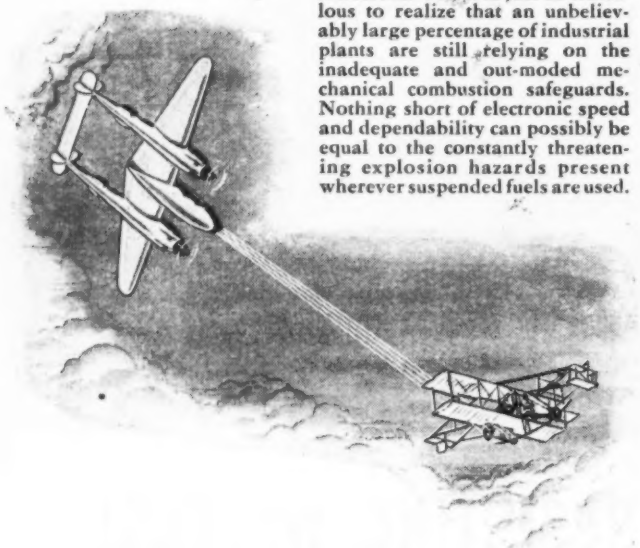
3. Where fly-ash travel is greatest, special ribbed liners protect the alloy steel blades. These liners, easily and quickly renewed, prolong wheel life, save maintenance time and labor, minimize outage losses.

B. F. STURTEVANT COMPANY
Hyde Park Boston 36, Mass.

Sturtevant
REG. U. S. PAT. OFF.
Puts Air to Work

RIDICULOUS

To imagine the original Wright Brothers plane engaged in present day combat, certainly would be ridiculous. Yet, it is just as ridiculous to realize that an unbelievably large percentage of industrial plants are still relying on the inadequate and out-moded mechanical combustion safeguards. Nothing short of electronic speed and dependability can possibly be equal to the constantly threatening explosion hazards present wherever suspended fuels are used.



WHEELCO FLAME-OTROL

(Electronic Combustion Safeguard)

—offers the ultimate in protection from these hazards through instantaneous electronic action. The Flame-otrol instantly shuts off the fuel to the burner in case of flame failure, disturbance in the electrical system, or should any condition develop within the instrument itself which might interfere with its operation. It is the fastest operating combustion safeguard on the market. The Flame-otrol operates with equal efficiency on gas, oil, powdered coal or any combination of these fuels. You can have the Flame-otrol with automatic or manual ignition, time delay for purging or other desirable sequences. Approved and listed by both the Underwriters' Laboratories and the Associated Factory Mutual Laboratories. Delay in installing Flame-otrols may mean needless loss of life and investment.

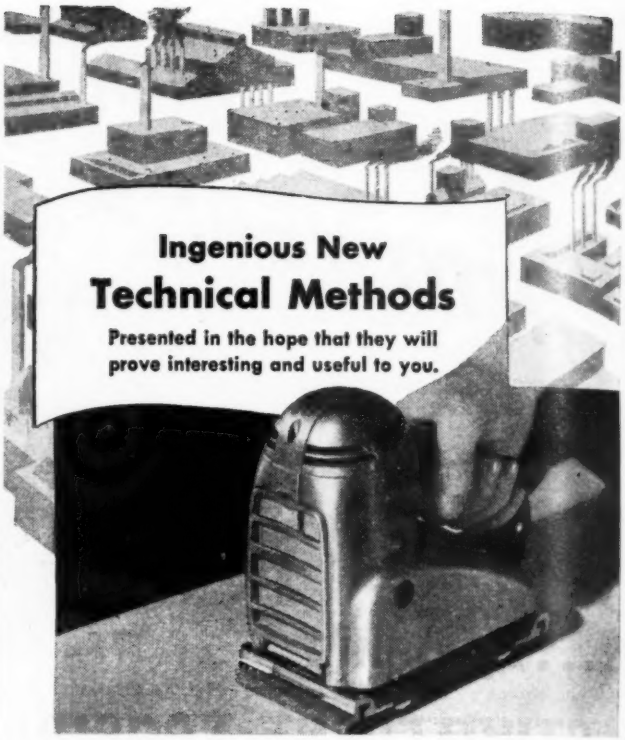
Request Bulletin L2 for detailed information.

WHEELCO INSTRUMENTS COMPANY

863 West Harrison Street, Chicago 7, Illinois

Creators of "Electronic Principle" Temperature Controls

See the Flame-otrol and other Wheelco Instruments on display in Booth 525-527 National Exhibition of Power and Mechanical Engineering, Madison Square Garden, New York. Nov. 27-Dec. 2.



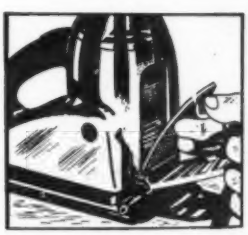
Ingenious New

Technical Methods

Presented in the hope that they will prove interesting and useful to you.

No Vibration in New "Orbital Action" Portable Electric Sander; Relieves Workers' Fatigue

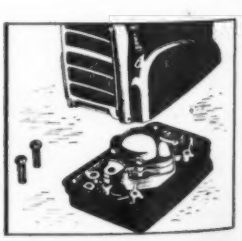
A boon to workers' nerves and health, this new "Orbital Motion" electric sander is actually vibrationless. A great saver of workers' energy as well as man-production hours, the sander can be operated easily in horizontal, vertical or inverted position with one hand. Compared to manual sanding, this machine achieves superior results at least eight times faster. It performs equally well on wood, metal or plastics.



Easily-removed filter cleans air that cools motor—prolongs motor life and reduces maintenance costs.

Developed for war industry, this revolutionary new sander has done yeoman duty in this country's manufacturing plants and in allied maintenance and repair depots all over the world.

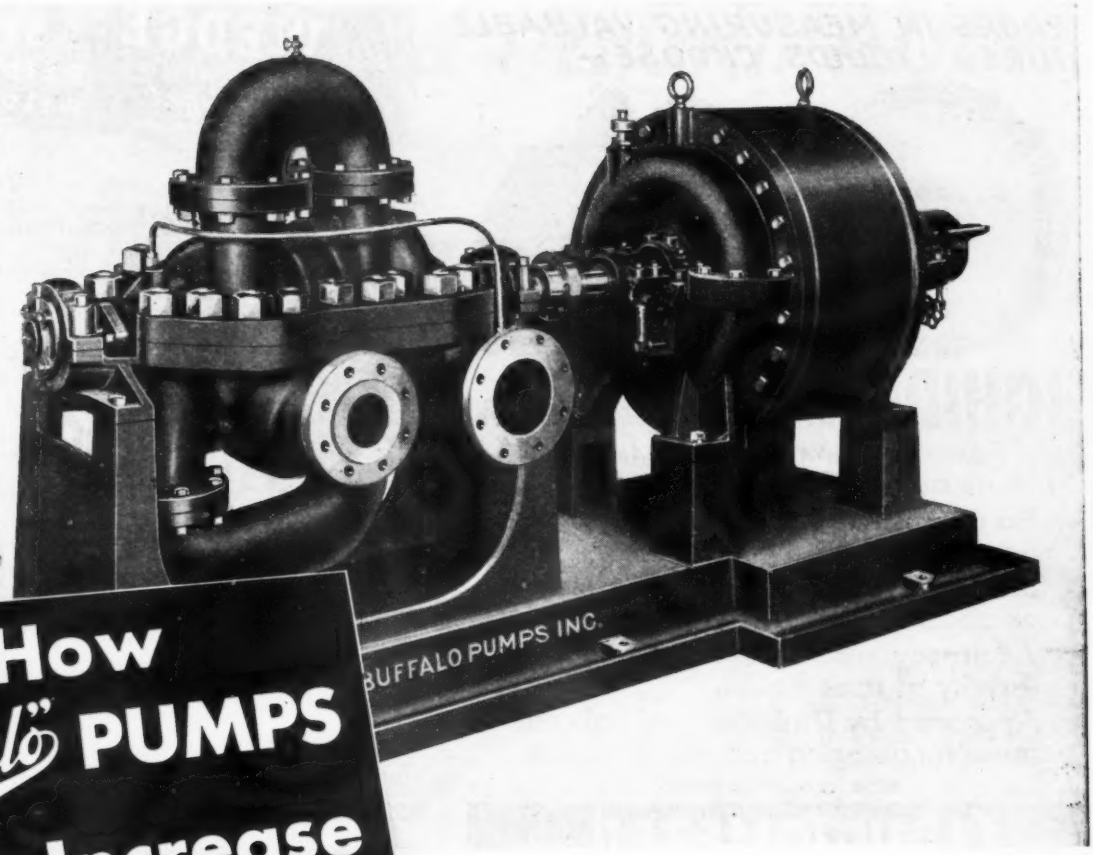
Wrigley's Spearmint Gum renders a real service to workers too—eases dry throat and relieves tension that brings on fatigue, leaving both hands free to stay on the job. The Army and Navy were quick to appreciate these benefits, that's why they are now shipping to our fighting forces overseas only, our entire limited production of Wrigley's Spearmint. Just as soon as we can supply the home front, too, industry will again enjoy the benefits of Wrigley's Spearmint Gum now proving so important on the battle fronts.



Dustproof transmission synchronized to eliminate vibration. Oil supply lubricates for 100 operating hours.

You can get complete information from the Sterling Tool Products Company, 155 East Ohio Street, Chicago 11, Ill.

Y-161



How "Buffalo" PUMPS Help Increase Production

This bulletin No. 980-A describes Buffalo Type "RR" Pumps. Send for your copy.

● Many industrial plants depend on uninterrupted operation of their power plants. Boiler-feed pumps built by "Buffalo" are serving in many power plants where twenty-four hour, month-in-and-out operation is an absolute necessity.

The design of Type "RR" pumps makes full mechanical provision for heavy-duty operation. Note the rugged, over-size construction. Large stuffing boxes make packing maintenance simple. Full accessibility to rotor and all parts is easy. Hydraulically, the design gives high operating efficiency on any clear water service.

Your plant can use Buffalo "RR" Pumps to advantage. Why not let us quote on your requirements?

Sales Representatives in all principal cities.

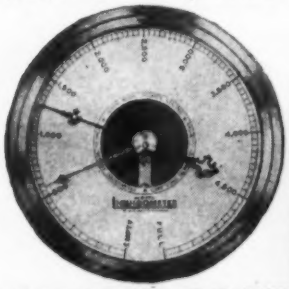
BUFFALO PUMPS, INC.

448 Broadway **Buffalo, N. Y.**

Canada Pumps, Ltd., Kitchener, Ont.

"Buffalo" **Type RR Centrifugal Pumps**

THOSE WHO CAN'T AFFORD TO MAKE ERRORS IN MEASURING VALUABLE STORED LIQUIDS CHOOSE—



LIQUIDOMETER *Tank Gauges*

"THEY'RE ALWAYS DEPENDABLE"

100% automatic.

No pumps, valves, or auxiliary units needed to read them.

Models available for either remote or direct readings.

Accuracy unaffected by specific gravity of tank liquid.

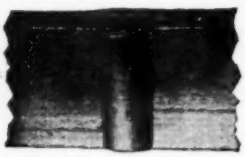
Approved by Underwriters' Laboratories for gauging hazardous liquids.

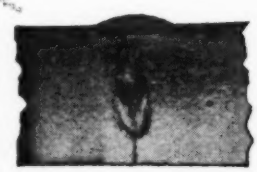
Write for complete details.

THE LIQUIDOMETER CORP.
39-16 SKILLMAN AVE., LONG ISLAND CITY, I, N.Y.

Use WEDGE CHILL RINGS *and get* . . . STRONG REINFORCED WELDED JOINTS

You can greatly increase the efficiency of pipe welding by using WEDGE Chill Rings with the patented SPLIT Feature. They reinforce the joints and assure 100% PENETRATION, see unretouched photos below. In case of shock, strain or vibration the reinforced joints will not break. By using WEDGE Chill Rings you can weld FASTER and obtain good work from less skilled help—your skilled help can do more. Why not investigate?





Write for circular and prices

WEDGE PROTECTORS, INC.
9524 Richmond Ave. Cleveland 5, Ohio

WEDGE CHILL RINGS SAVE MONEY

WHITLOCK

A NEW BOOKLET

Just off the press! Here's an interesting and helpful booklet to make your heat transfer equipment serve you better. It contains much information based on Whitlock's years of experience in building and servicing thousands of heat exchangers.

In simple language Whitlock Engineers offer suggestions on installation, operation and maintenance of heat exchangers, with suitable instructions for cleaning and operating your present equipment for peak efficiency. All those interested in the application of heat transfer equipment will find this booklet a valuable source of information.

Send for your copy to-day.

The WHITLOCK MANUFACTURING COMPANY

Established 1891—Ahead of the times for half a century

46 South Street, Elmwood, Hartford 1, Connecticut

Branch Offices: NEW YORK, BOSTON, CHICAGO, PHILADELPHIA, DETROIT, RICHMOND

Authorized representatives in other principal cities—consult local telephone directory under our name.

Whitlock Equipment (Whitlock-Darling) is manufactured in Canada by Darling Brothers, Ltd., Montreal.

FOSTER *FACTS and INFORMATION*

on REGULATION ENGINEERING

To help you with your control or regulation problems...steam, hydraulic, air or gas... you should have Foster Catalog 70.

Steam flow charts, gas tables, data on efficient liquid transfer and much related engineering information are clearly given in Catalog 70.

In addition, you will find descriptions, drawings, specifications and operating data on a complete line of regulating valves and accessories.

Catalog 70, requested on company letterhead, is yours for the asking. And so are the services of our engineering staff—for special problems—without obligation.

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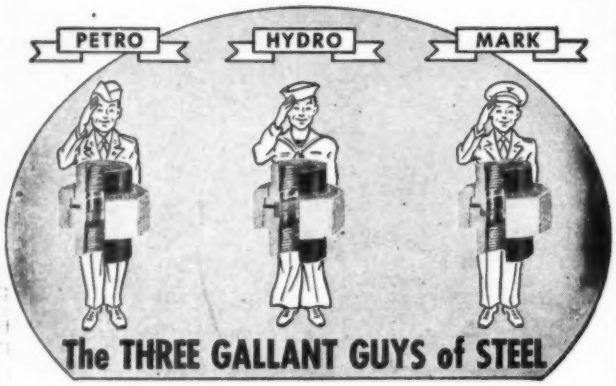

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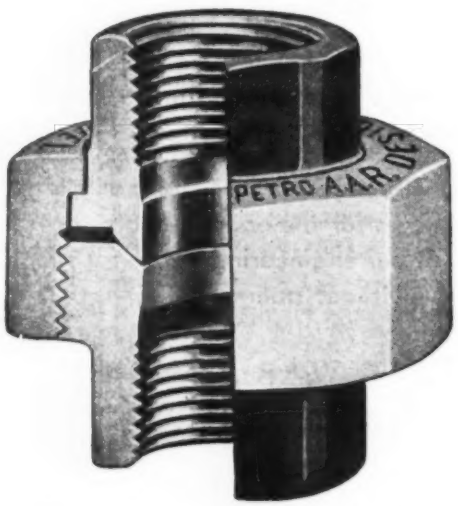

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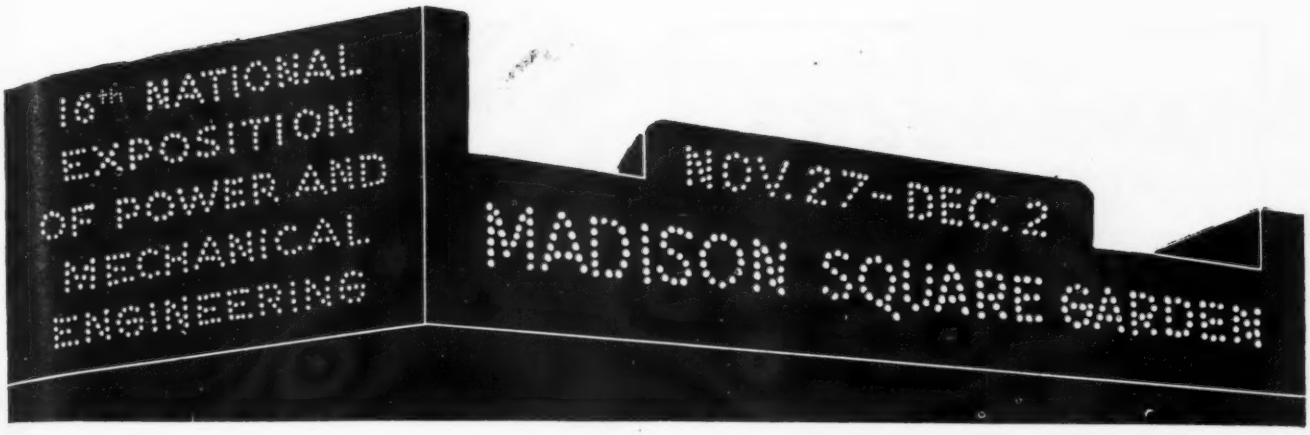

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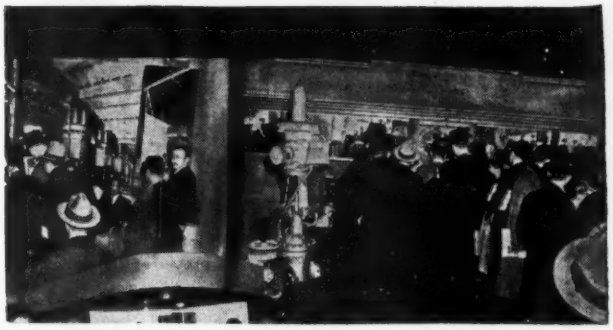

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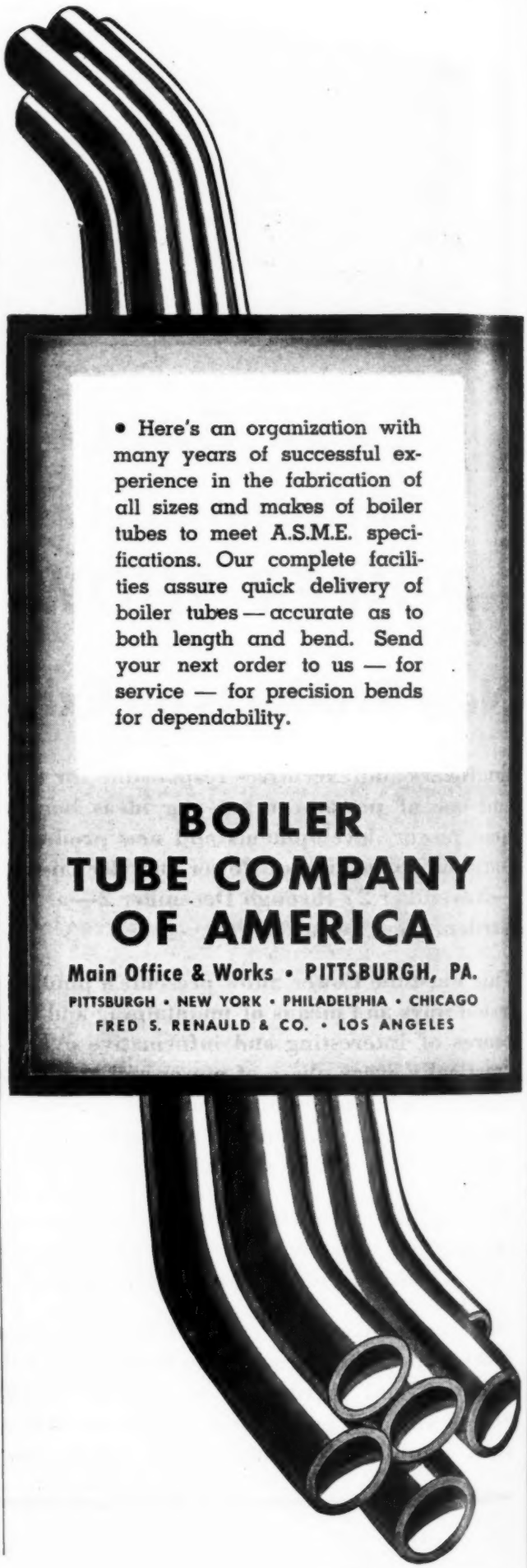

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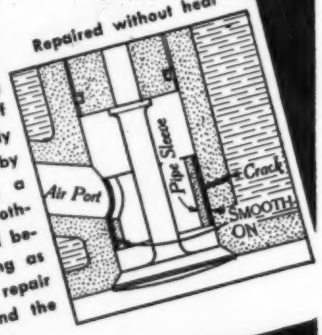

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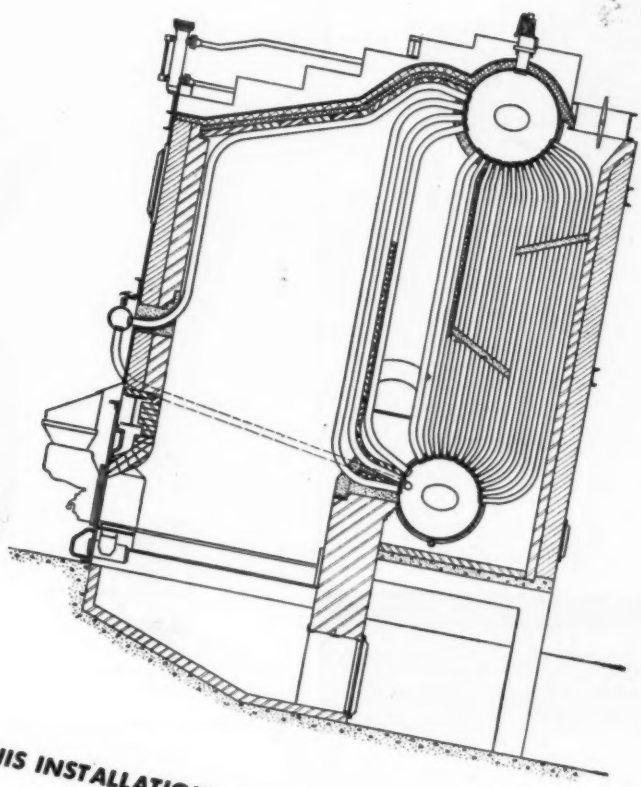

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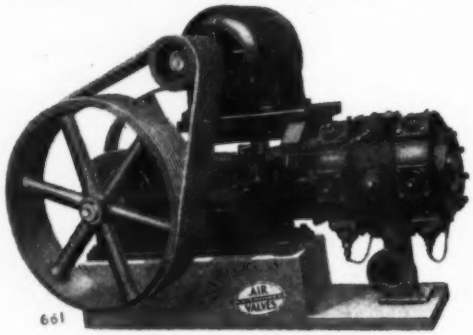

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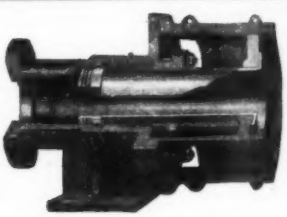

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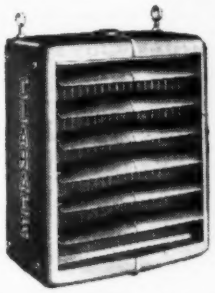

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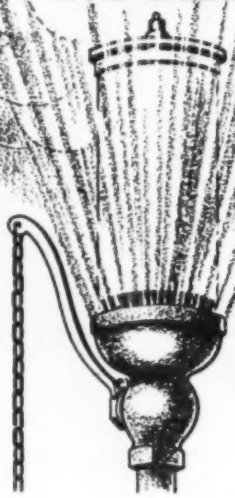

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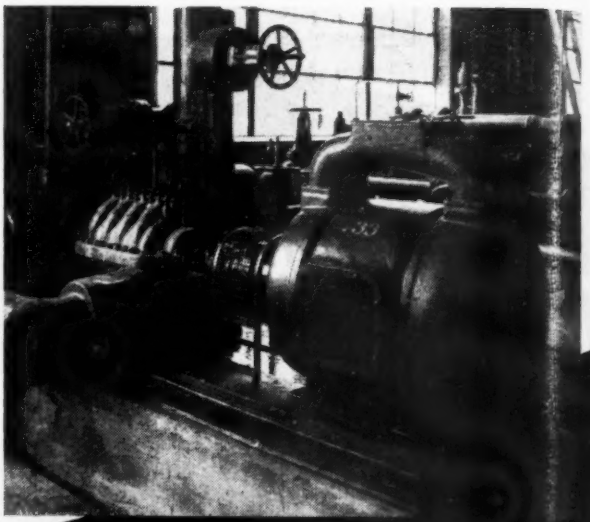

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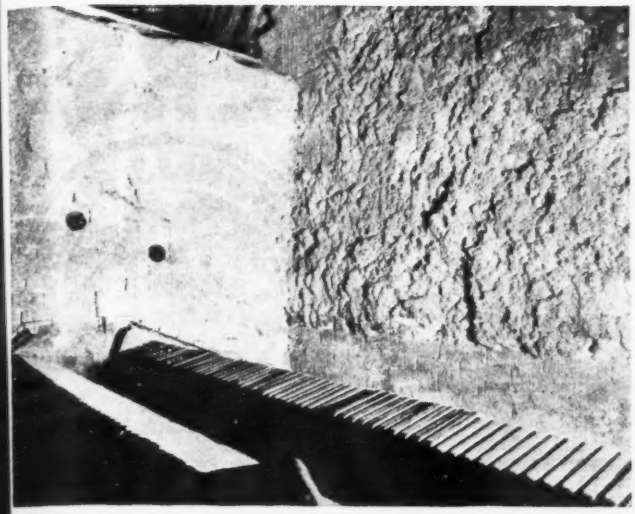

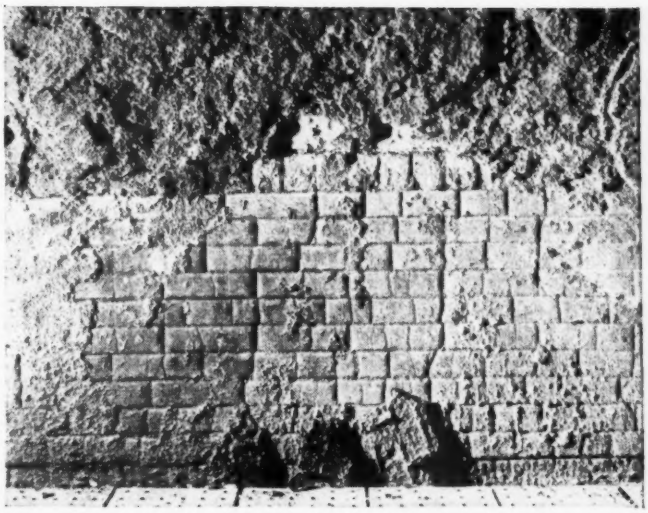

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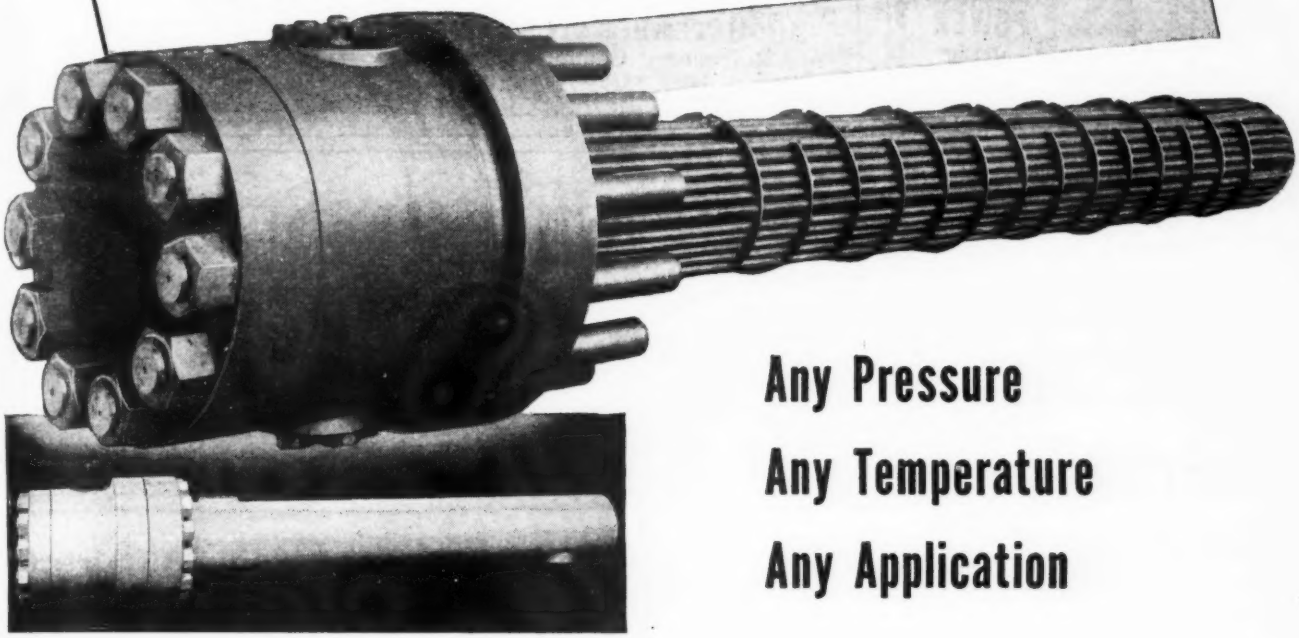

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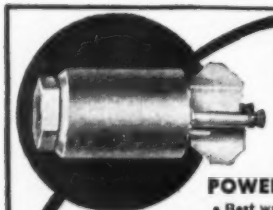

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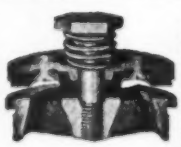

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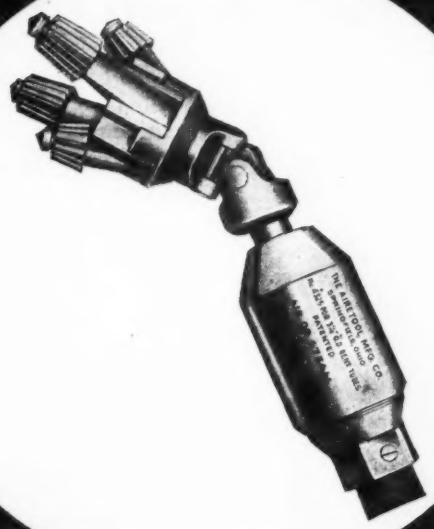

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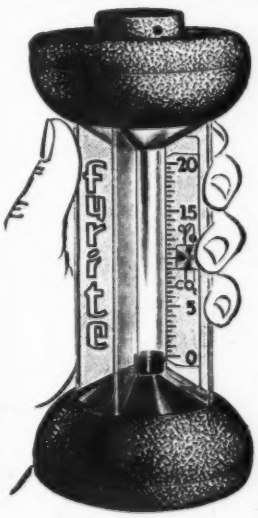

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POSITIONS VACANT

WANTED: A Mechanical engineer to take charge of designing and manufacturing slip-type or packed type expansion joints. Man required must have experience in this line. Not a duration job. Employees of this company have knowledge of this advertisement. Compensation commensurate with applicants abilities. Give details of experience. P-727, Power, 330 W. 42nd St., New York 18, N. Y.

WANTED—MECHANICAL engineer with good experience in modern power plant design to take charge of engineering department of mechanical contractor not engaged in or affected by war work. Should have experience in estimating power plant piping and layout work. Some construction experience and structural steel experience desirable but not absolutely necessary. Excellent opportunity for permanent position at good salary in well established business with advancement to execute position. Applicant should send preliminary information as to experience and salary to permit arrangement personal interview at companys expense. P-735, Power, 520 N. Michigan Ave., Chicago 11, Ill.

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WANTED: COMBUSTION engineer with experience in chemical process equipment. Must be able to fired boilers in sizes 10 to 500 HP. State age, experience, availability and salary expected in first letter. If employed at present on essential war work do not apply. P-756, Power 330 W. 42nd St., New York 18, N. Y.

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P-760 Power
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POSITIONS VACANT

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MECHANICAL ENGINEER: With engineering degree. Experience with chemical process equipment desirable. Able to prepare designs for chemical process projects from flow sheet information, prepare specifications, and order major equipment. Senior designers who feel they might qualify for project engineers acceptable. Give full particulars, experience, education, salary expected, and photograph. Applicant employed will be required to have certificate of availability or referral card from U. S. Employment Service. This is an essential industry. P-758, Power, 330 W. 42nd St., New York 18, N. Y.

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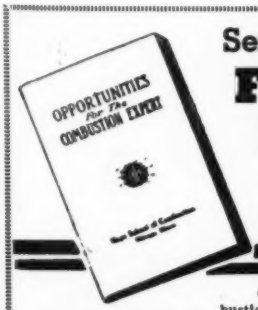

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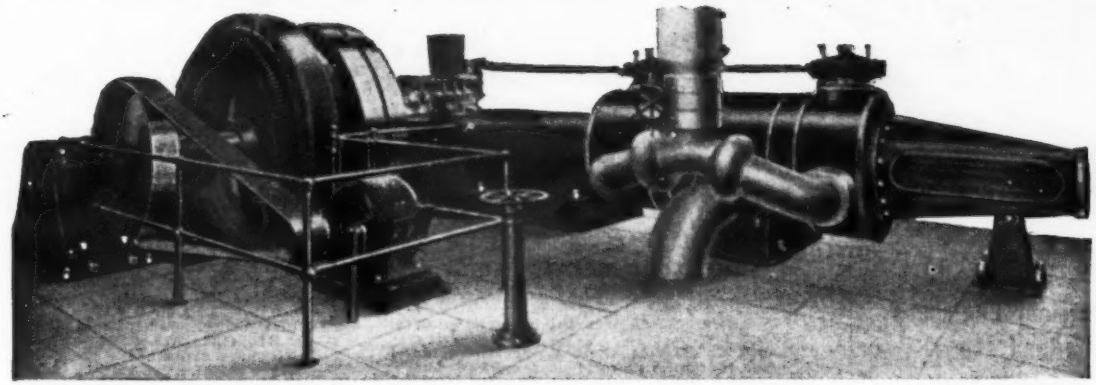

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250 volts D.C.

500 KW CROCKER WHEELER AMES 4 cylinder vertical uniflow 150 lbs. 4 lbs. back pressure.

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TURBO GENERATOR 250 volts D.C.

TURBO GENERATOR

250 volts D.C.

500 KW GENERAL ELECTRIC automatic extraction 150 lbs. 0-28 lbs. extraction with surface condenser

TURBO GENERATORS

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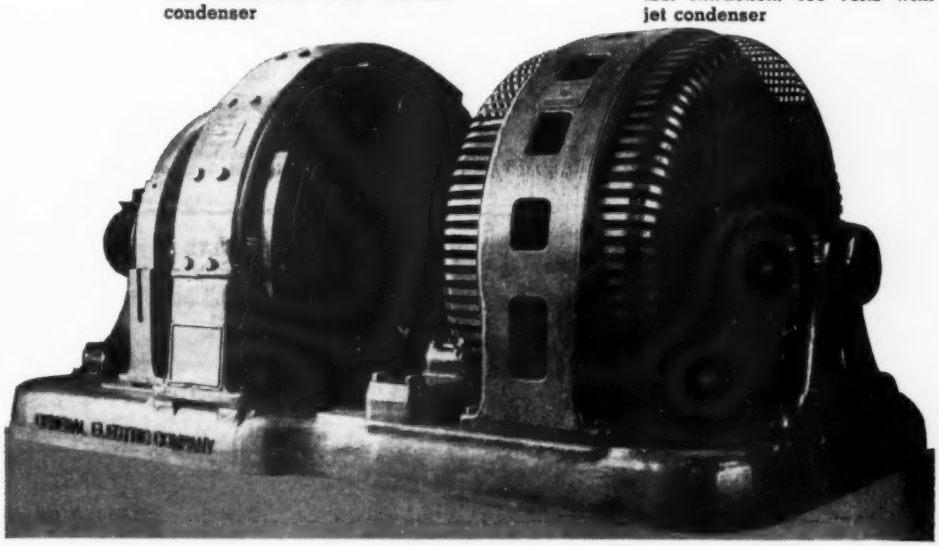
3125 KVA GENERAL ELECTRIC automatic extraction, 175 lbs., 5-30 lbs. extraction, 480 volts with jet condenser

1250 KVA ALLIS CHALMERS condensing 150 lbs. 2300 volts with jet condenser

1250 KVA ALLIS CHALMERS automatic extraction, 300 lbs. 10-35 lbs. extraction, 480 volts with jet condenser



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1000 KW (2) General Electric generators 250 volts, 720 RPM direct connected to 1400 HP General Electric synchronous motors, 3 phase 60 cycle 4150/2300 volts. *Complete with control. Can be shown in operation.*

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1—750 KW, 250 volt, Allis Chalmers, synchronous.
1—75 KW, 125 volt, General Electric, squirrel cage.
1—20 KW, 600 volt, General Electric, squirrel cage induction motor.
2—15 KW, 250 volt, General Electric, squirrel cage.
1—6½ KW, 125 volt, General Electric, squirrel cage.

ALTERNATORS

1—625 KVA, 3600 RPM, 600 volt, G.E.
1—250 KVA, 720 RPM, 2300 volt, G.E.
1—200 KVA, 3600 RPM, 240 volt, Allis Chal.
1—62½ KVA, 3600 RPM, 220 volt, Allis Chal.

MOTORS—3 PHASE 60 CYCLE

1—500 HP, 900 RPM, Lincoln, 440 volt, slip ring.
1—350 HP, 300 RPM, 440 volt, General Electric slip ring.
1—300 HP, 720 RPM, 2200 volt; G.E. slip ring.
1—250 HP, 600 RPM, 4000 volt, G.E., syn.
1—200 HP, 600 RPM, 2200 volt, G.E., sl. rg.
1—150 HP, 1800 RPM, 440 volts, General Electric, squirrel cage.
1—150 HP, 1750 RPM, Westinghouse, sl. rg.
2—150 HP, 1200 RPM, 2200 volt Westinghouse, squirrel cage.
1—150 HP, 900 RPM, 440 volt, Al. Ch. sl. rg.
1—150 HP, 600 RPM, 220 volt General Electric, synchronous.
1—125 KVA, 900 RPM, 220 volt Westinghouse, synchronous.
3—100 HP, 720 RPM, 440 volt, G.E., sl. rg.
1—125 HP, 720 RPM, Allis Chalmers, sl. rg.
1—100 HP, 720 RPM, 440 volt, G.E., sq. cg.
1—100 HP, 600 RPM, 440 volt, G.E., sl. cg.
2—100 HP, 450 RPM, 440 volt, G.E., sq. cg.
1—90 HP, RPM, 550 volt, Cr. Whir. sq. cg.
1—75 HP, 900 RPM, 4000 volt, Elec. Mach. syn.
1—75 HP, 900 RPM, 220 volt, Fairbanks Morse, slip ring.
1—75 HP, 720 RPM, 440 volt, Westghse., slip ring.
1—75 HP, 720 RPM, 440 volt, G.E., sq. cg.
2—75 HP, 1200 RPM, 2200 volt, G.E., Vertical.
1—50 HP, 900 RPM, 440 volt, G.E., sl. rg.
1—50 HP, 900 RPM, 440 volt, G.E., sq. cg.

SPECIAL
1—1000 Gallon GPM Worthington fire pump with 100 HP, 440 volt General Electric motor.

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2—450 HP, G.E., 400 RPM, Type MPL Form 1-F.
1—250 HP, 760 RPM, Electro Dynamic.
2—150 HP, Westghse., 550 RPM, Type SK.
1—150 HP, 750 RPM, Electro Dynamic.
1—125 HP, 600 RPM, Westinghouse, SK.
1—100 HP, G.E., 575 RPM.
1—100 HP, 625 RPM, G.E.
1—80 HP, Crocker-Wheeler, 600 RPM, Type CMC.
1—75 HP, G.E., 575 RPM, Type C, Sprague; with spare armature.
1—65 HP, 1000 RPM, G.E., Type RC.
8—50 HP, Crocker-Wheeler, 700 RPM, Type CM.
1—65 HP, G.E. 625 RPM Type DLC—65, Form A.
1—50 HP, 750 RPM, Westghse., Type SK.
1—50 HP, 700 RPM, Crocker-Wheeler.
1—40 HP, G.E.-Sprague, 700 RPM, Type LC.
1—40 HP, 775 RPM, Westinghouse.
1—40 HP, 300 RPM, G.E.
1—30 HP, 750 RPM, G.E., Type RC.
1—30 HP, G.E., 750 RPM, Type RC-14, Form A.
1—30 HP, G.E., 1100 RPM, Type RC-31B, Form A-21.
1—35 HP, G.E., 650 RPM, Type RC-15.
1—30 HP, G.E., 625 RPM, Type C.
1—25 HP, Westghse., 600 RPM, Type SK.
2—25 HP, G.E., 775 RPM, Type RC-13.
1—20 HP, G.E., 800 RPM, Type RC-13, Form A.
1—15 HP, G.E., 800 RPM, Type RC-11.

TRANSFORMERS

2—100 KVA, G.E., 4156-250/480 v., Scott taps.
3—300 KVA, Pittsburgh, 7800/440 volts.
3—200 KVA, Allis-Chalmers, 2200-220/110.
3—150 KVA, G.E., 33000/2300/4000 Y.
4—150 KVA, General Electric, 2200/220/440 volts.
3—100 KVA, Westinghouse, 11,430/250 volts.
3—100 KVA, Westinghouse, 13200-250 volts.
3—100 KVA, Allis-Chalmers, 2200/220/110 volts.
3—75 KVA, G.E., 13,500-750/440 volts.
3—75 KVA, General Electric, 2200/220/110.
1—75 KVA, G. E., 3 phase, 4156Y—120/208Y.
3—50 KVA, G.E., 2200/220/110.
2—50 KVA, Pbgh. 7500/15000 volts-110/220 volts
3—37½ KVA, G.E., 2200/220/440.
2—15 KVA, G.E., 2300-115/230 volts.

MOTORS—VARIABLE SPEED 230 VOLTS

1—90 HP, 470/940 RPM, General Electric.
1—75 HP, 525/1575 RPM, Electro Dynamic.
1—35 HP, 350/1050 RPM, Electro Dynamic.
1—30 HP, 225/900 RPM, Crocker Wheeler.
1—30 HP, 400/1200 RPM, General Electric.
7—25 HP, Westinghouse, 650/2200 RPM, Type SK-110L.
2—25 HP, 300/900 RPM, Electro Dynamic.
1—15 HP, 300/1200 RPM, G.E.
1—13/18 HP, 350/1200 RPM, Electro Dynamic.
3—11½ HP, 500/1500 RPM, Westinghouse.
1—10 HP, 400/1600 RPH, Westinghouse.
1—5 HP, 600/1200 RPM, General Electric.
1—5 HP, 450/1800 RPM, Crocker Wheeler.
1—5 HP, 400/1600 RPM, Diehl.
1—5 HP, 225/900 RPM, Electro Dynamic.

TURBO GENERATORS

600 KW Terry dual bleeder condensing Turbine only.
1—500 KW, G.E., 3 ph., 60 cy., 430 volt, bleeder.
1—375 KVA, Westghse., non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 v., con.
1—200 KW, G.E., 3 ph., 60 cy., 220 v., cond.

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Hemphill FOR POWER

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Electrical Engineering and Equipment
OFFICE AND WAREHOUSE
1602 53rd STREET
NORTH BERGEN, N. J.
PHONE NEW YORK—LONGACRE 5-3227
NEW JERSEY—UNION 3-2600

How the Policy of BELYEA Protects You—*the buyer*

(4) "As fast as conditions allow." This is the only way anyone can sincerely describe present day delivery schedules. The policy of the Belyea Company is to make all deliveries at the very earliest possible moment after orders are received.

Production time is of utmost importance to you—the buyer. Since all the equipment advertised by Belyea is owned outright there is a minimum of lost time between the date of the order and the time the rebuilding work starts.

It is not the policy of Belyea to sacrifice rebuilding standards for short shipments, for we fully realize the loss of production time that would ultimately result from such a practice.

Remember this—you get a guarantee of successful operation with all Re-Nu-Bilt equipment.

(1) ANALYSIS OF YOUR PROBLEMS

(2) CONSERVATIVE RECOMMENDATIONS

(3) CONSISTENT STANDARDS OF REBUILDING & TESTING

(4) TIME SAVING DELIVERY SCHEDULES

(5) REASONABLE PRICE POLICY

MOTOR GENERATOR SETS

3 phase—60 cycle

1—1500 KW, G.E. 275 v D.C. to 2100 HP, 2300 v syn.

1—1000 KW, G.E. 275 v D.C. to 1400 HP, 2300 syn.

1—600 Kva, G.E. 330 KW, 220/440 v A.C. Gen. to 500 HP, 230 v D.C. motor

1—500 KW, G.E. 600 v D.C. to 700 HP, 13200/6600 syn. with exciter

1—500 KW GE 250 v D.C. to 700 HP, 2300 v Syn.

1—500 KW, G.E. 275 v D.C. to 1000 Kva, 2300 v syn.

1—400 KW, G.E. 275 v D.C. to 700 HP, 2300 v syn.

1—300 KW G.E. 275 v D.C. to 400 Kva 2300 v syn.

1—250 KW GE 275 v DC to 375 HP, 2200 v Syn.

1—200 KW G.E. 125 v D.C. to 400 Kva 2300 v syn.

1—175 KW GE 125/250 DC to 260 HP, 440 v Syn.

1—100 KW GE 125/250 DC to 225 HP, 440 v Syn.

1—75 KW, G.E 125 v D.C. to 120 HP, 2300/4000 v

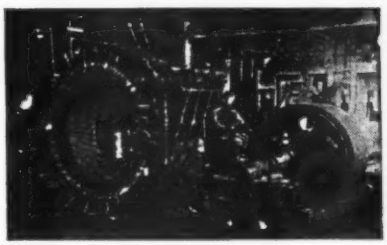
1—50 KW, G.E., 125 v D.C. to 75 HP, 2300/4000 v

1—25 KW, G.E. 125 v D.C. to 40 HP, 220 v sq. cg.

FREQUENCY CHANGERS

1—75 KW, G.E., with 94 Kva .8 PF, 240 volt, type ATB, 3 phase, 62½ cycle gen. and 125 HP, 440 volt, 3 phase, 25 cycle motor

1—1000 KW, G.E., with 1250 Kva, .8 PF, AQB, 2300 volt, 3 phase (can be changed 800 KW, 3 phase), 58.3 cycle gen. and 1400 HP, .8 PF, 4400/2300 volt, ATI, 3 phase, 25 cycle motor and exciter



A C MOTORS

3 phase—60 cycle

SLIP RING

Qua.	Hp	Make	Type	Volts	Speed
1	1200	Cr. Wh.	801Q	2300	237
2	1000	Whse.	CW	2300	720
1	800	Al. Ch.	ANY	440	885
2	600	G.E.	IP	440/2200	720
1	600	G.E.	MT	550	220
1	450	Whse.	HF	2200	875
1	400	G.E.	IP	2200	252
1	400	Al. Ch.	ANY	2300	505
1	400	G.E.	IP	440/2200	600
1	350	G.E.	MT-442Y	2200/4000	253
1	300	G.E.	IM	440	900
3	250	Whse.	CW	440/2300	450
1	250	G.E.	MT-424Y	4000	257
1	200	G.E.	IM	440	600
1	200	Whse.	CW	2200	514
1	150	G.E.	I-17B	2200	290
1	150	Whse.	CW-772C	2200	1160
1	150	G.E.	IM-16	2200	575
1	100	G.E.	IM	550	720
2	100	G.E.	IM	2200	575
1	100	G.E.	MTC	550	685
1	100	G.E.	IM	220	1750

SQUIRREL CAGE

Qua.	HP	Make	Type	Volts	Speed
1	300	Whse.	CS	550	580
1	300	G.E.	IK-17B	550/440	600
1	300	G.E.	IK-17	440	900
1	200	G.E.	IK	550	600
1	200	G.E.	IK	440	900
1	200	G.E.	IK-17B	2200	490
2	175/112	G.E.	IK-16	400	900/720
1	150	Whse.	CS	550	400
1	125	Whse.	CS	550/220	1150
1	100	G.E.	KT	440	1800
1	100	G.E.	IK Vert	2300	450

ROTARY CONVERTERS

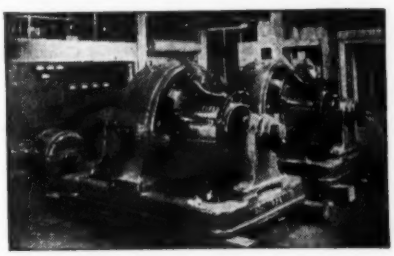
3 phase—60 cycle

Qua.	KW	Make	Speed	DCv	Trans V
1	1500	Whse.	720	600	2300
1	1500	Whse.	600	600	11500
1	1250	G.E.	720	260	2300
1	1000	G.E.	900	600	13200
1	1000	Whse.	900	600	11000
1	1000	Whse.	720	250	22000
2	750	G.E.	1200	600	2300
1	750	Whse.	720	250	6600/2300
1	500	Whse.	1200	600	13200/6600
2	375	G.E.	1200	250	6600/2300

3 phase—25 cycle—Booster Type

1	1500	G.E.	500	225/275	13200/6600
1	500	G.E.	750	225/275	13200/6600

All units can be furnished with AC and DC Panels.



D. C. MOTORS

Qua.	HP	Make	Type	Volts	Speed
2	1250	G.E.	MPC	500	130
1	1200	Whse.	Int.	600	600/720
1	1200	G.E.	MPC	600	450
1	800	G.E.	MPC	550	600
2	625	G.E.	MPC	500	130
1	500	Whse.	Int.	250	250/720
1	500	G.E.	MPC	230	900
1	300	G.E.	DMC	230	400/600
1	300	G.E.	MPC	230	275/550
1	250	Al. Ch.	Int.	230	525
1	175	Whse.	SK	250	150/525

RENUBILT BELYEA MOTORS

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BELYEA COMPANY INC.

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L. J. LAND AND COMPANY

Dependable Electric Equipment for War and Peace Time Production

DIRECT CURRENT

(Partial List Only)

230 VOLT DC MOTORS

H.P.	Make	Speed
60	El. Dynam.	900
60	Roth	600
60	G.E.	480/1100
50	West.	550/1100
50	Cr. Wh.	700 (2)
50	G.E.	850
45	Diehl	850/1020
40	El. Dy.	1200
40	Cr. Wh.	915
35	West.	1150
25	Diehl	850/1020
25	G.E.	1150
25	G.E.	575
20	R & M	1160
20	G.E.	1150
20	West.	1150
20	G.E.	800 (2)
15	West.	1250
15	G.E.	1150
15	Cr. Wh.	900/1800
15	West.	850
10	West.	850
10	G.E.	825
10	G.E.	700
10	Al. Ch.	600/1800
10	West.	600/1200
10	G.E.	400/1600
10	West.	400/1200
9	G.E.	450/1800
8½	Diehl	900
8½	West.	850
8½	West.	350/1400
7½	Sturt.	3600
7½	Peerl's	1700
7½	West.	1450
7½	West.	1150 (2)
7½	G.E.	1150
7½	West.	975
7½	Al. Ch.	850
7½	El. Dy.	550/1650
7½	Watson	525/1150
7½	G.E.	400/1600
7½	West.	400/1600
7½	Al. Ch.	350/1050
7½	G.E.	300/1200
6	G.E.	400/1200
6	G.E.	450/1800 (2)
5½	West.	500/1500 (2)
5	West.	850
5	G.E.	900 (2)
5½	G.E.	400/1600
5	West.	1800
5	G.E.	1700
5	G.E.	1150 (2)
5	West.	1100
5	Al. Ch.	1150
5	Cont.	600/1800
5	West.	850
5	G.E.	850
5	Star	600/1200
5	El. Dy.	550/1650
5	G.E.	450/800
5	G.E.	600
5	G.E.	450/1350
5	West.	400/1200
5	El. Dy.	275/1100
4	G.E.	850/1150
3½	West.	850/1600
3	West.	1700
3	West.	1150 (6)
3	Roth	500/2000
3	G.E.	500/1500
2½	West.	480/1800

236 additional 230 volt D. C. Motors in stock as small as 1/20 H.P.

115 VOLT DC MOTORS

H.P.	Make	Speed
90	G.E.	900
20	West.	200/900
15	West.	1100
15	Cr. Wh.	800
10	L. Allis	3500
10	West.	850
10	El. Dy.	425/1275
7½	G.E.	850 (2)
6	Burke	650
5	Cr. Wh.	1875
5	West.	1100 (2)
5	Cr. Wh.	960

75 additional 110 volt Motors down to 1/6 H.P.

BELTED AND MOTOR DRIVEN DC GENERATORS

100 KW West.	125 volts
100 KW West.	250 volts
75 KW West.	250 volts
60 KW Al. Ch.	250 volts
60 KW G.E.	600 volts
60 KW G.E.	125 volts
50 KW G.E.	250 volts
50 KW West.	125 volts
45 KW West.	250 volts
30 KW El. Dy.	600 volts
40 KW Cr. Wh.	125 volts
30 KW West.	125 volts
25 KW West.	125 volts
25 KW G.E.	250 volts
20 KW G.E.	125 volts
15 KW West.	125 volts

43 additional Motor Generator Sets, 30 volts, 60 volts, 125 volts, 250 volts, and 250 volts as small as ½ K.W.

ALTERNATING CURRENT

(Partial List Only)

2 & 3 PHASE SLIP RING

H.P.	Make	Speed
250	G.E.	600
125	Burke	580
112	G.E.	900
100	F. M.	690
75	West.	1170
75	Al Ch.	575
64	G.E.	585
60	West.	1135
60	West.	290
50	G.E.	870 (2)
50	West.	850
40	Wagner	1150
40	F. M.	870
40	West.	870
40	Linc.	690
30	G.E.	870
30	G.E.	690
15/35	West.	6/1200 (5)
25/55	G.E.	6/1200
20/50	West.	6/1200
25	Al. Ch.	870 (2)
25	West.	850
25	G.E.	870 (2)
25	G.E.	720
25	West.	575
20	G.E.	870
20	West.	575

116 additional Slip Ring Motors in stock down to ½ H.P.

3 PHASE SQUIRREL CAGE MOTORS

H.P.	Make	Speed
200	G.E.	600
150	G.E.	860
150	West.	715
100	G.E.	1200
100	G.E.(BTA)	375/750
75	West.	870
50	West.	1200
50	G.E.	900
40	G.E.	900
35	Wagner	850
30	U. S.	3450 Vert.
30	West.	1750
30	Al. Ch.	514
25	Wagner	1200
25	West.	1140
25	Diehl	865
25	G.E.	900
25	Wagner	720
20	G.E.	1750
20	G.E.	1200
20	Cr. Wh.	1200
20	Al. Ch.	900
20	Diehl	900
20	G.E.	720
20	West.	1720

29—15 H.P. 4 speed 600/900/1200/1800 RPM Constant H.P. Ball Bearing motors, West, and Louis Allis

15	Cr. Wh.	1700
15	G.E.	1200
15	Wagner	720
15	G.E.	600
10	G.E.	720
10	G.E.	3450
10	West.	1150

325 additional three phase Motors down to ¼ H.P.

TWO PHASE SQUIRREL CAGE MOTORS

H.P.	Make	Speed
50	Linc.	900
50	G.E.	900
40	G.E.	900
40	Al. Ch.	900
35	Al. Ch.	900
30	West.	1200
25	G.E.	1200
20	West.	1150
15	G.E.	1200
15	F & M	900
10	G.E.	1200
10	G.E.	900
7½	G.E.	900
7½	G.E.(BQS)	600/1350
5	G.E.	900
5	Al. Ch.	1200

146 additional two phase Motors down to ¾ H.P.

SINGLE PHASE MOTORS

H.P.	Make	Speed
20	Wagner	1160
20	Cont.	1165
7½	Cont.	3500

AC GENERATORS

150 KW G.E.	720
125 KW Cr. Wh.	900
100 KVA West.	600
60 KW G.E.	1200
25 KVA West.	1200

New York City's Largest Stock Electrical Machines

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ONLY PARTIAL LIST

TRANSFORMERS

1—200 KVA GE, type H.K. 2300/115/230 volts, 1 PH. 60 cy.
2—200 KVA GE, type H Form VD 4800/2400/480 volts, 1 PH. 25 cy.
3—150 KVA A.C., 4800/2400/120/240 volts, 1 PH. 60 cy.
2—150 KVA Pittsburgh, 2300/115/230 volts. 1 PH, 60 cy.
2— 75 KVA West. type S.K. 1 ph. 25 cy. 60000 volts Prim—6900/2300 volts secondary.

OTHER SIZES, VOLTAGE AND CYCLES AVAILABLE

ALTERNATORS

250 K.W.—(312 KVA) Gen.-Elect., Type A.T.I.—2300/4600 volt. 60 cycle 150 R.P.M. P. F. .08 with separate belted exciter.
240 KW, 8 PF Electric Machinery, 4600 volts, 60 cycle 3 phase, 450 R.P.M. with direct connected exciter.
200 K.W. Westh. Unity Power Factor, 3 PH. 60 cyc. 220/440 900 R.P.M. with direct connected exciter.
150 KVA Westinghouse, 3 phase, 60 cycle, 2300 volts, 600 R.P.M. Revolving field with direct connected exciter.
150 KVA Gen. Elec. Type ATB form D, 60, 3 ph., 220/440 600 with Rev. Field, and built in Exc.

MOTOR GENERATOR SETS

Western Elect. 1000 Amps—40 volts direct con. to either AC or DC 580 RPM Motor.

CRANE MOTORS

75 H.P.—G. E. 51—230 Volts—550 RPM
35 H.P.—G. E. Form D—550 Volts—590 RPM

D. C. GENERATORS

150 KW Western Elec. 3 brg. 3 wire, 115/230 V. 600 R.P.M.
50 KW Gen. Elec. DLC—Comp. Ind. 125 V.—1150 R.P.M.

FREQUENCY CHANGERS

25 K.W. Gen. Elec. Type I.T.T. Frame 326—3 Ph 60/120 Cy. 440 volt Prim. 220 volt SPC. 1200 R.P.M. Dir. Con. to 25 HP. G. E. KT 326—3 Ph. 60 Cy. Motors.

ALL SIZES VOLTAGES AND CYCLES

3 ph. 25 cy. MOTORS

H.P.	Make		Type	Speed	Volts
350	Gen. Elec.	Sl. Rg. 3 Brg.	I	375	440
200	Lincoln	S. R.	I. X. W.	500	440
150	Gen. Elec.	Sl. Rg.	I Form M	500	2200
100	Wagner	Sl. Rg.	BR	750	220–440
100	Gen. Elec.	Sq. C.	I K	750	220/440
75	Wagner	Sq. C.	BM	750	2200

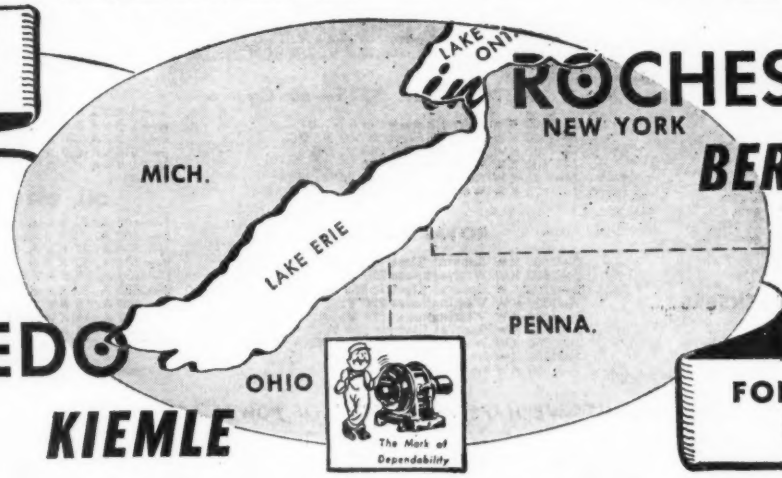
3 ph. 60 cy. A. C. MOTORS

H.P.	Make		Type	Speed	Volts
200	West.	Syn.-Dir. Con. Ex.	P. F. .08	900	220/440
200	Gen. Elec.	Syn.	ATI	514	4000/2300
200	Weghse.	Syn.	Dir. Con. Exc.	600	2300
150	Burke	Sq. Cg.	3 BRG. 2 ph.	900	220/440
25	Gen. Elec.	Sq. Cg.	I. K. Vert.	720	220

230 D. C. MOTORS

H.P.	Make	Type	Speed
85	Gen. Elec.	Vert. Comp. Wound	700
75	Crocker Wh.	CCM25JA	1700
60	Sprague	D — Comp. Wound	625
50	Gen. Elec.	C. L. 6 Shunt Wound	500
40	Fair. Morse	Ball BRG. Vert. Comp.	1740
35	West.	SK 150 — Shunt Int. 550 volts	850

OVER 10,000 STOCK ITEMS



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FOR IMMEDIATE DELIVERY

TRANSFORMERS

3—500 KVA, GE, type H, form VD525 19100-22000/40000Y to 2300 1 phase 25 cycle.
1—350 KVA, GE, type H-K.D.D. 2300/460—1 PH, 60 Cy.
1—200 KVA Maloney type H.E. 2400/120/240 volts, 1 phase 60 cycle.
3—40 KVA West. SK. 1 Ph. 60 Cy. 6900 Volt Prim 2300 Volts Sec.

OTHER SIZES VOLTAGE AND CYCLES AVAILABLE

ALTERNATORS

10 K.W. Gen. Elect. 1 Ph. 60 Cy. 220 Volts—1800 R.P.M.

D. C. GENERATORS

50 K.W. G.E. CL00—Comp. WD. 250 volts 1080 R.P.M.

MOTOR GENERATOR SETS

Gen.-Elect—100 KW. 2 brg. 125 volts D.C. Comp WD-Int. with 220/400 volts. Sq. Cg. Motor.

300 KW Gen. Elect. Synchronous Converter, 6 Phase, type HCC form J, 25 cycle 750 speed with transformers for 2300 volts to 230 volts D.C.

3 ph. 60 cy. A. C. MOTORS

H.P.	Make		Type	Speed	Volts
200	Weghse.	Sl. Rg.	CW	600	220/440
150	Gen. Elec.	Sq. Cg.	I.K.	600	2300
100	Gen. Elec.	S. C.	K.T.	720	440
100	Gen. Elec.	S. C.	FTR	1150	440
100	Lincoln		M	1150	440
100	Gen. Elec.	SR	MT	600	440

3 ph. 25 cy. MOTORS

H.P.	Make		Type	Speed	Volts
150	Gen. Elec.	S. R.	IM	500	440
100	Allis Ch.	S. R.		750	440
75	Gen. Elec.	Var.	BTA	375/750	440
75	Gen. Elec.	S. R.	I M 17B	160	440
75	Gen. Elec.	Sl. Rg.	I M	750	220/440

230 D. C. MOTORS

H.P.	Make	Type	Speed
150	West.	SK 180L Comp. Wd. Int.	1150
100	Northwestern	K30 Comp. Inter.	1750
50	Crocker Wheele	CM	625

Rebuilt and Sold with a Standard New Guarantee

Put all idle equipment to work. Send your list for prompt action. WRITE OR WIRE YOUR INQUIRIES

Above KIEMLE OFFERS

THE PICK OF POWER EQUIPMENT

TURBO UNITS—60 Cy.

1—15300 KVA Westinghouse Cond.
1— 6250 KVA General Electric Cond.
1— 4000 KW General Electric Cond.
1— 4000 KVA Allis Chalmers Cond.
1— 3125 KVA General Electric Cond.
1— 3125 KVA Westinghouse Cond.
1— 3125 KVA General Electric Extrac.
1— 1563 KVA General Electric Cond.
1— 1563 KVA Westinghouse Extrac.
1— 1250 KVA General Electric Cond.
1— 937 KVA General Electric Cond.
1— 750 KVA General Electric Cond.
1— 625 KVA General Electric Non-C.
1— 312 KVA Moore Non-Condensing
1— 250 KVA Westinghouse Non-C.
1— 125 KVA Westinghouse Non-C.
1— 107 KVA Westinghouse Non-C.

STEAM ENGINE UNITS—60 Cy.

1—1067 KVA Nordberg Uniflow
1— 375 KVA Nordberg Uniflow
1— 325 KVA Skinner Uniflow
1— 300 KVA Hamilton 4-valve
1— 210 KVA Skinner Uniflow
1— 150 KVA Skinner Uniflow
1— 94 KVA Ridgway 4-valve
1— 93.8 KVA Skinner Uniflow

D. C. STEAM ENGINE UNITS

1—500 KW Ames Uniflow 250 V.
1—400 KW Ridgway 4-valve 275 V.
1—350 KW Ridgway 4-valve 250 V.
1—250 KW Ames Uniflow 250 V.
1—200 KW Skinner Uniflow 125 V.
1—150 KW Ridgway 4-valve 125/250 V.
1—125 KW Ridgway 4-valve 250 V. 3-wire
1—100 KW Elliott 4-valve 250 V. 3-wire

OIL & GAS ENGINE UNITS—60 Cy.

1—625 HP Worthington, 240 V. gen.
1—610 HP Campbell, 2400 V. gen.
1—600 HP West. (gas), 480 V. gen.
1—520 HP Busch Sulzer, 2400 V. gen.
1—375 HP Worthington, 240 V. gen.
1—360 HP Anderson, 2300 V. gen.
1—360 HP Fair.-Morse, 2400 V. gen.
1—300 HP Worthington, 2300 V. gen.
1—283 HP Coop.-Bess., 230 V. gen.
1—175 HP Sterling (gas), 480 V. gen.
3—160 HP Coop.-Bess., 216 V. gen.
1—145 HP Superior, 220 V. gen.

SURFACE CONDENSERS

1—20,000 sq. ft. Worthington
1—12,000 sq. ft. Worthington
1— 5,000 sq. ft. Westinghouse
1— 4,100 sq. ft. Ross

WATER TUBE BOILERS

1—850 HP B. & W. 250-lb., Stoker
1—750 HP Edge Moor 200-lb.
2—612 HP Stirling 200-lb., Stokers
1—600 HP Union 250-lb., Stoker
2—560 HP Erie City 460-lb.
2—512 HP Stirling 205-lb.
1—335 HP B. & W. 200-lb.
2—300 HP Heine 200-lb.
2—300 HP B. & W. 160-lb.

A. C. GENERATORS

2—1500 KVA G. E. 25 cy. 2200 V. 750 RPM
2—1250 KVA G. E. 60 cy. 480 V. 750 RPM
1— 750 KVA G. E. 60 cy. 230-460 V. 300 RPM
1— 680 KVA G. E. 25 cy. 13200-4000 V. 300 RPM
1— 500 KVA G. E. 60 cy. 2300 V. 360 RPM
1— 360 KVA West. 60 cy. 240 V. 360 RPM
1— 94 KVA G. E. 60 cy. 2300 V. 600 RPM
1— 48 KW Elec. Mcy. 60 cy. 2400 V. 1200 RPM

SYNCHRONOUS MOTORS

2—1250 HP G. E. 25 cy. 2200 V. 750 RPM
2—1125 HP G. E. 60 cy. 480 V. 720 RPM
1— 850 HP G. E. 25 cy. 13200-4000 V. 300 RPM
1— 770 HP G. E. 60 cy. 230-460 V. 300 RPM
1— 620 HP G. E. 60 cy. 440 V. 164 RPM
1— 150 HP West. 60 cy. 2200 V. 600 RPM
1— 100 HP G. E. 60 cy. 2300 V. 240 RPM (Super)

INDUCTION MOTORS—60 Cy.

4—3500 HP G. E. slip ring 2300 V. 120 RPM
1—2500 HP G. E. slip ring 6600 V. 253 RPM
1—1500 HP G. E. slip ring 6600 V. 253 RPM
1—1000 HP G. E. sq. cage 2300 V. 509 RPM
1— 600 HP G. E. sq. cage 440 V. 900 RPM
2— 400 HP G. E. slip ring 3800 V. 1800 RPM
2— 300 HP G. E. sq. cage 440 V. 600 RPM
2— 250 HP G. E. sq. cage 2300/4000 V. 1200 RPM
3— 230 HP West. slip ring 2300 V. 720 RPM

MOTOR GEN. SETS—60 Cy.

1—1500 KW Allis Chalmers 600 V. DC
1—1000 KW General Electric 600 V. DC
1—1000 KW Westinghouse 250 V. DC
1— 300 KW Westinghouse 600 V. DC
1— 75 KW General Electric 125 V. DC
1— 75 KW Westinghouse 250 V. DC

ROTARIES—60 Cy.

2—2600 KW General Electric 250 V.
2—2500 KW Westinghouse 250 V.
2—1700 KW General Electric 250 V.
1—1500 KW Westinghouse 250 V.
2—1000 KW Westinghouse 250 V.
2— 750 KW General Electric 600 V.
1— 750 KW Westinghouse 225/275 V.
1— 500 KW General Electric 250 V.
1— 500 KW General Electric 600 V.

FREQUENCY CHANGERS

2—12500 KW G. E. 60/25 cy. 300 RPM
2— 5000 KVA West. 25/60 cy. 300 RPM
2— 3125 KVA West. 25/62½ cy. 750 RPM
1— 2500 KVA West. 25/60 cy. 300 RPM
1— 1875 KVA G. E. 25/60 cy. 300 RPM
2— 1250 KVA G. E. 25/62½ cy. 750 RPM
1— 1250 KVA G. E. 25/60 cy. 300 RPM
1— 750 KVA G. E. 25/60 cy. 300 RPM
1— 750 KVA G. E. 60/25 cy. 300 RPM

SYN. CONDENSERS—60 Cy.

1—5000 KVA West. 5000 V. 720 RPM
2—1250 KVA G. E. 480 V. 720 RPM
1— 750 KVA G. E. 230-460 V. 300 RPM
1— 500 KVA West. 2200 V. 900 RPM

TRANSFORMERS—1 Ph. 60 Cy.

3— 2500 KVA Pitts. 66000-25400/12700 V.
1— 1500 KVA Pitts. 66000-33000 V. 3 ph.
3— 1250 KVA G. E. 66000-13200 V.
3— 750 KVA Pitts. 66000-33000
3— 1667 KVA G. E. 44000-2300/4000 Y V.
3— 200 KVA G. E. 33000-2300/4000 Y V.
3— 150 KVA G. E. 33000-2300 V.
3— 75 KVA G. E. 33000-13200/11000 V.
1—15000 KVA Al. Ch. 27880-4560 V. 3 ph.
2—10000 KVA West. 26400-4580 V. 3 ph.
1— 6000 KVA West. 26400-2300 V. 3 ph.
2— 1000 KVA G. E. 23000/11500-575 V.
3— 833 KVA G. E. 22000-2300/4000 Y V.
3— 667 KVA Packard 23000-440 V.
3— 250 KVA G. E. 22000-11000 V.
1— 6000 KVA West. 13200-2300 V. 3 ph.
6— 1667 KVA Pitts. 13200-2300 V.
3— 1000 KVA G. E. 13200-2300 V.
3— 200 KVA G. E. 13200-2300 V.
3— 200 KVA G. E. 13200-480 V. Pyranol
7— 667 KVA Moloney 11000-2300 V.
3— 150 KVA Pitts. 11000-2400 V.
3— 100 KVA West. 11000-250/125 V.
3— 1250 KVA G. E. 6600-550 V.

VOLTAGE REGULATORS
60 Cycle Induction

6—96 KVA 400 A. 2400 V. Gen. Elec.
1—72 KVA 300 A. 2400 V. Gen. Elec.
2—48 KVA 200 A. 2300 V. West.
6—36 KVA 150 A. 2400 V. Gen. Elec.
6—24 KVA 100 A. 2400 V. Gen. Elec.

OIL CIRCUIT BREAKERS

1— 400 A. 73 KV G. E. FK036 Outdoor
1— 400 A. 73 KV G. E. FHK036 Outdoor
1— 800 A. 37 KV G. E. FHK0136 Outdoor
6— 400 A. 37 KV G. E. FHK0136 Outdoor
4— 400 A. 34.5 KV Condit D-16-A Outdoor
2—1000 A. 30 KV Kelman CB76 Outdoor
2— 400 A. 15 KV G. E. FHK0136 Outdoor
1—2000 A. 15 KV West. E6 Indoor
1—1500 A. 15 KV West. E6 Indoor
2—1500 A. 15 KV G. E. FK12 Indoor
6—1200 A. 4.5 KV Condit D-12 Indoor
2—1000 A. 4.5 KV Condit D-12 Indoor

PARTIAL LIST—WE HAVE ALL CLASSES OF POWER EQUIPMENT

BREW, WOLTMAN & CO., INC.

50 CHURCH STREET, NEW YORK CITY 7, NEW YORK

TURBO-GENERATORS

A FEW OF THE COMPLETE UNITS NOW IN OUR STOCK

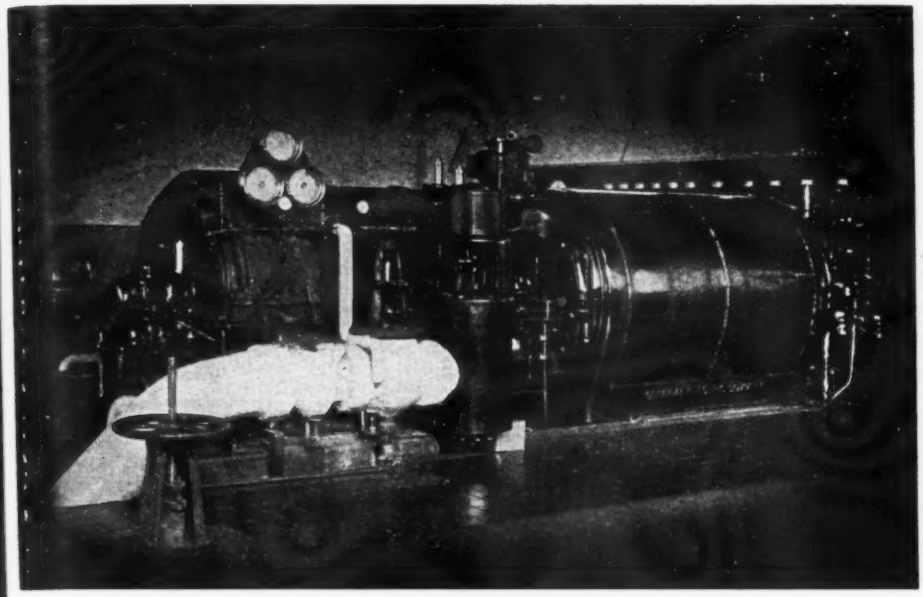
1—6250—KVA. G.E. 3/60/2300V. 200#
1—3125—KVA GE 3/60/2300V. 200#
2—1875—KVA GE 3/60/2300V. 200#
1—1000—KW. DC. West. 3/60/250; 135/200#
1—1563—KVA. G.E. Non-Cond.
1—937—KVA GE Automatic Extraction 3/60/2300 V. 200 lbs.
2—937—KVA Allis-Chal. 3/60/2300:200#
1—250—KVA GE. Non-Cond. 3/60/480

Also Any Capacity or Type Desired.

WILMS, WEAVER & COMPANY

PENOBSCOT BLDG. DETROIT 26, MICHIGAN

3125 KVA CONDENSING TURBINE-GENERATOR UNIT AVAILABLE IMMEDIATE DELIVERY



ACTUAL PHOTOGRAPH

3125 KVA — 2500 KW 80% P.F. General Electric, 3 phase, 60 cycle, 2300 volt, 3600 RPM condensing turbine-generator unit, 180-200# I.S.P. 500° T.T., equipped with surface condenser, panels and instruments.

Excellent condition—a complete installation.

TURBINE-GENERATOR UNITS

3 phase, 60 cycle

1875 KVA G.E. condensing 175-200 lb. pressure, 500° T.T. 6600 volts, 3600 RPM complete with condenser.

750 KVA G.E. non-condensing, 175-200 lb. pressure, 15 lb. back pressure, 480 volts, 3600 RPM, complete with switchboard.

625 KVA G.E. condensing 200 lb. pressure, 2300 volts, 3600 RPM complete with condenser and auxiliaries.

375 KVA G.E. condensing 150-200 lb. pressure, 100° SH, 2300 volts, 3600 RPM complete with surface condenser and auxiliaries.

62.5 KVA Allis-Chalmers-Terry non-condensing, 125-140 lbs. pressure, 0 to 10 lbs. gauge back, 240 volts, 3600 RPM complete direct connected shaft exciter and rheostats.

ENGINE-GENERATOR UNITS

Direct Current

1000 KW Westinghouse, 250 volts, 514 RPM generator direct connected through reduction gear to Westinghouse condensing turbine, 150-200 lb. pressure, equipped surface condenser.

600 KW Crocker-Wheeler, 250 volts, 300 RPM generator direct connected to a 14" x 18" 4 cylinder Ames vertical Unaflow non-condensing engine, 150-175 lb. pressure, 5 lb. back pressure, complete with switchboard.

350 KW G.E. 250 volt, 175 RPM generator direct connected to a 28" x 28" Skinner Universal Unaflow non-condensing engine.

125 KW, 125 volt, 250 RPM generator direct connected to 18" x 16" Elliott engine, 100 lb. pressure, 10 lb. back pressure, complete with switchboard.

75 KW 125 volt, 1800 RPM Westinghouse direct current non-condensing turbine-generator unit.

75 KW, 125 volt, 2400 RPM Allis Chalmers-Terry noncond. turbine-gen. unit.

15 KW (3) Crocker-Wheeler, 125 volt, 410 RPM generators each direct connected to an American Blower vertical engine.

ENGINE-GENERATOR UNITS

3 phase, 60 cycle Alternating Current

500 KVA (2) Westinghouse, 440 volts, 164 RPM generators each direct connected to Skinner Unaflow non-condensing engine, 135 to 150 lbs. steam pressure, 5 lb. back pressure.

375 KVA G.E. 2300 volts, 150 RPM generator direct connected to a Chuse cross compound 4-valve non-releasing Corliss engine.

350 KVA (2) General Electric, 2300 volts reconnectable for either 550/480 or 240 volts, 200 RPM generators each direct connected to Skinner automatic engine.

312 KVA Elliot 4000 2300/550 or 240 volts, 180 RPM generator direct connected to a 17" x 24" Elliott Unaflow non-condensing engine, 175 lb. pressure, 6 lb. back pressure.

250 KVA Westinghouse, 2300 or 480 volts, 200 RPM generator direct connected Nordberg Unaflow engine.

150 KVA Allis 240 volt, 225 RPM generator direct connected Skinner Universal Unaflow engine.

MOTORS

—3 phase, 60 cycle

500 HP Westinghouse 2200 volt, 1750 RPM squirrel cage induction.

125 HP 80% P.F. Elec. Mchy. 440 volts, 400 RPM synchronous.

60 HP G.E. 220 volts, 900 RPM squirrel cage induction complete with starting compensator.

50 HP G.E. type I, form M, 2200 volts, 1200 RPM slip ring

SYN. MOTORS

3 phase, 25 cycle

1700 HP G.E. 2300 volts, 300 RPM.

910 HP Westgh. 2300 volts, 300 RPM.

MOTOR GENERATOR SET

1500 KW Allis-Chalmers, 600 or 275 volt direct current generator direct connected to 2190 HP, 3 phase, 60 cycle, 4000/6600 volt, 300 RPM synchronous motor.

FREQUENCY CHANGER SET

750 KVA Westinghouse, 3 ph., 60-cy., 2300 v. alternating current generator dir. con. to 910 HP. 3 ph., 25 cy., 2300 v., 300 RPM syn. motor.

1200 KVA General Electric, 3 ph., 60 cy., 2400 v. alternating current generator dir. con. to 1700 HP, 3 ph., 25 cy., 2300 v., 300 RPM syn. motor.

SPECIAL OFFERINGS

9375 KVA Westinghouse, 3 phase, 60 cycle, 2300 volt, 1200 RPM alternating current generator.

1250 KVA G.E. 3 phase, 60 cycle, 2300/550/440 volts, 300 RPM alternating current generator.

500 KVA G.E. 3 phase, 60 cycle, 2300 volt, 450 RPM belted generator.

350 GPM, 720' head, 5 stage Allis-Chalmers centrifugal pump direct connected to 125 HP, 3 phase, 60 cycle, 2200 volt, 1750 RPM motor.

22" x 48' Nordberg Corliss belted type engine, 150 to 175 lb. pressure, 100 RPM.

Ingersoll-Rand steam driven air compressor, high pressure cylinders 16" x 20", air cylinders 25" x 15" x 20", 100 lbs. air pressure.

BOILERS

3—410 HP Wickes horizontal cross drum box header type, water tube boilers, complete with stokers and automatic fuel conveyors.

Utilities Electrical Machinery Corporation

600 NATIONAL CITY BANK BLDG.
CLEVELAND, OHIO

WIRE OR PHONE
LONG DISTANCE 422

Wagner "Certified Rebuilt" Electrical Apparatus

QUICK SHIPMENT—Partial Listings—*Send for Complete Catalog!*

SQUIRREL CAGE MOTORS

3 Phase—60 Cycles—220 or 440 Volts

Qua.	HP	Mfr.	Type	Speed
1	250	G.E.	I-K	900
1	150	Gen. Elec.	I-K	1200
1	150	Gen. Elec. 2200 v.	I-K	1800
1	125	Allis Ch.,	AR	1800
1	125	Whse. b.b. 2200 v.	CS771C	1800
1	100	Allis Ch.	AN	1800
1	100	Whse.	CCL	720
1	75	Whse.	CCL	720
1	75	Gen. Elec.	I-K	600
3	75	Allis Ch. 2200 v.	AR223	1800
1	75	Ideal	A	1200
2	50	Allis Ch.	AN	900
2	50	Gen. Elec.	KT336	1200
2	50	Gen. Elec.	I-K	900
1	50	Allis Ch.	AN	720
1	50	G.E. 2 phase	I-Q	1200
1	40	Whse.	CX	600
1	40	Gen. Elec.	I-K	1200
1	40	Wagner	19TRM	1200
2	40	Gen. Elec.	KT336	900
2	40	Allis Ch.	AR420	900
1	40	Howell b.b.	NC564	900
1	40	Gen. Elec.	KT342	720
2	30	Allis Ch.	AN	1200
1	30	Allis Ch. b.b.	AR220	900
2	30	Allis Ch.	AN	600
6	30	Allis Ch.	AN	900
2	30	Gen. Elec.	KT336	720
2	30	Whse.	CS567C	1200
1	30	Gen. Elec.	K505	600
2	30	Whse. b.b. New	CS405	1800
2	30	Allis Ch.	AN	720
4	25	Allis Ch.	AN	900
3	25	Gen. Elec.	I-K	1200
2	25	Gen. Elec.	KT522	1200
1	25	Fair Morse b.b.	H10C	3600
2	25	Allis Ch.	AN	600

SLIP RING MOTORS

3 Phase—60 Cycles—220 or 440 Volts

Qua.	HP	Mfr.	Type	Speed
1	400	G.E. 2200 v.	I-P	1200
1	300	G.E. 3 brg.	I-P	450
1	300	Burke	EMV	225
2	150	Triumph	SF	514
1	150	Gen. Elec.	I-M	720
1	100	G.E. 2200 v.	I-E13A	1800

SLIP RING MOTORS—Cont.

1	100	Gen. Elec. 3 brg.	I-M	450
1	100	Gen. Elec.	I-M	600
1	100	G.E. 2200 v.	I-M	720
1	75	Gen. Elec.	MT356	900
1	75	G.E. 2200 v.	I-E13	1800
1	75	Gen. Elec.	MT558	600
1	75	Gen. Elec. 2200 v.	I-M	900
1	65	P & H b.b. int.	CA16	900
2	60	Whse. 2200 v.	CW657	1800
3	60	Gen. Elec.	M-505	1200
1	50	Gen. Elec.	MT536	1200
1	50	Al. Ch. bb. 2200 v.	ARY	900
4	50	Allis Ch.	ANY	720
1	50	Gen. Elec.	MT342	900
1	50	Gen. Elec.	I-M	600
1	40	Northw'n	HW35A	1200
4	40	Gen. Elec.	MT532	1200
2	40	G.E. 2200 v.	MT332	1200
1	40	Howell	SR	3600
1	40	Gen. Elec.	MT546	514
1	40	Fair. Morse b.b.	HV-M12C	900
1	40	Whse.	CW	900
1	35	Fair. Morse b.b.	HV-12B	1800
2	30	Northw'n b.b.	HW404	1800
2	30	Allis Ch.	ANY	900
1	30	Whse.	CW	1200
1	25	G.E. 2200 v.	I-M	1200
1	25	Gen. Elec.	MT322	1200
2	25	Allis Ch.	ANY	900
1	20	Whse.	CW	1200
1	20	Wagner	19TRS	900

SYNCHRONOUS MOTORS

H.P.	Mfr.	Type	Volts	Speed
300	Whse.	ped.	220/440	900
250	G.E. 1 brg.	ATJ	220/440	600
100	Allis Ch.	SPF	220/440	600

60 CYCLE A. C. GENERATORS

KVA	Mfr.	Type	Volts	Speed
300	Whse.	ped.	240/480	900
250	Gen. Elec.	ATB	240/480	600
125	Whse.	ped.	2300	600
100	Cr. Wheeler		240/480	600
100	Gen. Elec.	ATB	240/480	900
50	Gen. Elec.	ATB	240/480	1200
40	Burke		240/480	1200

ALSO IN STOCK . . . 25 CYCLE & 2 PHASE MOTORS . . . OIL SWITCHES . . . PUMPS . . . BLOWERS & FANS . . . SPEED REDUCERS

D. C. GENERATORS

KW	Mfr.	Type	Volts	Speed
250	Northern		250	360
100	Gen. Elec.	DLC	250	700
55	Buliock	ped.	250	900
50	Gen. Elec.	CL	125	875
25	Gen. Elec.	DLC	125	900
25	Gen. Elec.	CD103	125	1150
20	Gen. Elec.	RC	230	1150
16	Cr. Wheeler	CCD	125	415

D. C. MOTORS

H.P.	Mfr.	Type	Volts	Speed
100	Gen. Elec.	DLC	230	575
100	Northwn.	interpole	230	1700
75	Whse.	S13L	230	450
60	Whse.	SK160	230	650
50	National	CS	230	800
40	Gen. Elec.	DLC	230	750
35	Whse.	SK	230	500/1000
30	Sprague	dynamom.	250	800/2000
30	Whse.	SK120	230	975
25	Gen. Elec.	LC	230	1700
25	Roth	elevator	230	725
25	Whse. enclosed	SK	250	600
20	Gen. Elec.	DLC	230	500/1500
20	Fair. Morse	TR	230	325/1300
20	Whse.	SK	230	850

M-G SETS

100 KW Gen. Elec. 3 brg. unit, type RC gen. DC 125V. coupled to 150 HP I-K sq. cage motor 3-60-2300/4000 V.—1200 RPM.

3—20 KVA Louis Allis b.b. rotary converters DC 230 V. to AC 3 ph. 60 cycle 220 V.

15 KW Allis Ch. DC 250 V. gen. coupled to 25 HP motor 3-60-220/440 V.—3 brg. unit.

CENTRIFUGAL PUMPS

14" Foster Wheeler, 5000 gpm @ 45 ft.
10" Weinman, 2500 gpm @ 40 ft.
8" Alberger, 2000 gpm @ 80 ft.
6" Platt, 1000 gpm @ 230 ft.

ARTHUR WAGNER COMPANY

1436-38 W. RANDOLPH STREET — CHICAGO 7, ILL. — MONroe 7409

POWER PLANT EQUIPMENT

Special Offerings

500 K. W.

General Electric Turbo-Generator Extraction Type, condensing—125 volts D.C. Complete with surface condenser, pumps, accessories and switchboard. Can be seen in operation

Condition practically equal to new

6700 CFM

General Electric Centrifugal Compressor 22# guage discharge pressure. Driven by 675 H.P.G.E. Turbine. Condensing type. Will develop 10,000 CFM by installing new first stage nozzles. Complete with surface condenser, expansion joints, butterfly valve and atmospheric relief valve.

Condition excellent.

4100 Sq. Ft.

C. H. Wheeler, 2 Pass Surface Condenser complete with pumps. Condition excellent.

Write or wire for additional data and prints.

A. LEE ELLIS CO., U. S. Mchy. Bldg., Boston, Mass.

The Buyer Must Be Satisfied—Always

POWER PLANT

3—200 H.P. Brady Scotch Type, Horizontal, Self Contained, A.S.M.E. Code, 125 lb. Boilers, arranged for coal firing, complete with regular steam trimmings, steel flue, Cochrane Open Type Heater, Boiler Feed Pumps, CO2 Recording Equipment, Damper Regulator and complete Schutte Koerting Oil Fuel System, disconnected.

1—50 K.W. Westinghouse 125 vo. D.C. Generator, 400 amps., 100 R.P.M. to 14" x 30" Wetherill Corliss Engine.

1—75 K.W. Westinghouse 125 vo. D.C. Generator, 600 amps., 100 R.P.M. to 16" x 30" Wetherill Corliss Engine.

1—100 K.W. Westinghouse 125 vo. D.C. Generator, 800 amps., 100 R.P.M. to 18" x 30" Wetherill Corliss Engine.

All in fine condition, ready for prompt shipment.

DELTA EQUIPMENT CO.
148 N. 3rd St. Phila. 6, Pa.

REBUILT POWER EQUIPMENT

READY TO SHIP!

SLIPRING MOTORS—3 PH., 60 Cy.

H.P.	Make	Volts	R.P.M.	Type
5	G.E.	440	1200	MT
20	Westg.	220	1735	CW
50	G.E.	220/440	1160/560	CM-7
50	Westg.	440	1145	HF
50	Chandeys'n	220/440	1800	
50	Allis Chal.	220	490	
54	Allis Chal.	440	900	
75	G.E.	440	1200	I-M
75	West.	220/440/2200	580/290	CW
100	West.	220/440	685	CW
150/75	West.	220/440/2200	580/290	CW
150	West.	2200	375	CW
150	West.	2300	490	CW
150	West.	220/440	490	CW
185		2300	900	
260	Burke	440	600	EMV-65
300	G.E.	440	900	I
300		2300	720	
400	Westg.	2300	580	CW
400	Westg.	2200	435	CW-1214
1500	Westg.	2200	435	CW

ALTERNATING CURRENT MOTORS 3 ph. 60 cy.

H.P.	Make	Volts	R.P.M.	Type
25	West.	220/440/550	1200	CS
25	G.E.	220/440	580	KF
30	G.E.	440	1800	KT
30	Line. Elec.	220	600	
30	Duquesne	440	600	
30	Triumph	220	525	TR-138
30	Allis Chal.	220/440	1200	
35	Lincoln	220	720	
40	Howell	220	900	SO
40	Line. Elec.	220	900	
40	Westg.	440	900	C
40	G.E.	220/440	900	KF
40	G.E.	220/440	1160	K
40	Duquesne	220/440	850	
40	G.E.	440	1800	KT-527-4
50	Fair Morse	220	900	
50/150	West.	2200	360/720	CS-954
50	Western El.	220	570	KT-346
50	Chandeys.	220/440	1800	
50	Cr. Wh.	240/480	1200	Syn.
50	Duquesne	440	1200	
50	Allis Chal.	440	1800	AN
50	West.	440	1120	C
50	G.E.	220/440	1200	HI
50	Allis Chal.	2200	865	
50/32	G.E.	440	800/640	
60	Duquesne	440	1800	
75	Louis Allis	220/440	1770	505Y
	Adjusto speed—splash proof—ball bearing			
75	West.	2220/220/440	720	CS
75	West.	2300	1200	Syn.
100	Allis Chal.	220	1750	
100	Allis Chal.	220	600	
100	G.E.	440	400	I-K
125	West.	2300	1170	CS
125	G.E.	400	450	I
125	G.E.	220/550	400	I
150	New Amer.	480	720	Syn.
150	West.	220/440	327	Syn.
150	Wagner	440	1800	31V
150	G.E.	440	514	I
150	G.E.	220/550	450	I
150	G.E.	550	575	I-K
150	G.E.	2200/220/440	450/243	
150	Westg.	2200	327	LC-Syn.
150	G.E.	220/440	720	I-12
150	G.E.	2200	600	I-12
150	G.E.	220/440	514	I-12
50/100	West.	2200/440/220	360/720	CS
(Complete with Niles Speed Reducer, ratio 10:1)				
175	G.E.	2200	600	I-12
200	Westg.	440	1700	CS
200	Westg.	2200	900	
200	G.E.	220/500	514	I
200	G.E.	2200	720	I-12
250	G.E.	2200	1150	I-12
250	G.E.	220/440/2200	1150	I-K
250	G.E.	2200	900	I-12
200/250	G.E.	220/440/2200	720	I-K
300	G.E.	220/440/2200	900	I-K
400	West.	2200/220/440	500	CS
1000	G.E.	2300	509	K
1500	G.E.	2200/220/440	225	ATI-Syn.
2000	G.E.	2200/220/440	240	TS-Syn.
3500/4000	West.	4000/23000	900	Syn.

VARIABLE SPEED MOTORS—230 VOLT D.C.

H.P.	Make	R.P.M.	Type
2½	Westg.	450/900	SK-30
2½	G.E.	500/1000	RLC
2½	Reliance	500/1000	14T
2¾	Westg.	900/1800	SK
3	Jantz-Liest	650/1950	BI-DC
3	Roth (Enclosed)	500/1000	RS
3¼	West.	400/1600	SA
3½	Westg.	850/1700	
3½	Reliance	300/600	
5	Reliance	300/1800	21
7½	Westg.	450/900	80L
7½	Reliance	650/1300	550v.
7½	Westg.	1125/2905	SK-43
7½	West.	400/1600	SA
7½	West.	425/850	SK
10	Westg.	565/1130	S-6
10	G.E.	625/1250	LC
10	West.	400/1600	SA
15	Louis Allis	1150/1750	NA
15	Reliance	500/1800	
15	West.	850/1700	SK-90
15	West.	675/1350	SK-100L
20	West.	900/1800	SK-100L
20	G.E.	270/540	
20	Westg.	750/1500	SK-110L
20	Westg.	750/1125	SK
30	G.E.	450/900	RLC
35	G.E.	375/1400	IC
50	G.E.	600/1200	500 v.
75	West.	475/950	SK-180
75	West.	400/650	SK-181

TRANSFORMERS—1 ph. 60 cy.

No.	KVA	Pri.	Sec.	Make
1	2	6600	110/220	G.E.
3	5	2300	220/440	G.E.
1	5	550	110	Pgh.
1	5	2200	110/220	West.
84	7½	2200	220/110	G.E.
32	7½	2200	220/110	West.
12	10	2200	220/110	West.
13	10	2200	220/110	G.E.
2	15	400/30000/50000		American
1	25	2200	220/110	G.E.
6	35	220	110	West.
3	37½	2200	440/220	West.
3	50	6600	575/440/220	G.E.
2	50	6600	550/440	Pgh.
2	50	6600	550/440	Al. Ch.
6	73	2200/4000	220/110	West.
6	73	440	205	West.
1	75	2200	220	Burke
6	75	2200	220/440	West.

INDUSTRIAL TRUCK

1—Baker Tow Truck with batteries.

HOIST

1—3 ton Westinghouse Hoist with Westinghouse DC Motor, 1600 rpm.

D.C. CLARK CONTROLLER

1—250 HP Clark Vari-time magnetic controller 230 v. DC reversing, used for plugging service. Can also be used non-reversing.

MOTOR GENERATOR SETS

250 Volts Compound Wound, D. C.—3 Ph., 60 cy. Motors

KW	Make	RPM	AC volts
2	Crocker Wheeler	1750	220/440
3	Westinghouse	1150	220/440
5	Allis Chalmers	1150	220/440
7½	Allis Chalmers	1150	220/440
10	General Electric	1150	220/440
15	Westinghouse	1150	220/440
20	Westinghouse	1150	220/440
25	Westinghouse	1150	220/440/550
35	G.E.	1150	220/440
35	Westinghouse	850	220/440
40	West.	1150	220/440
150	West.	900	220/440 syn.

1—100 kw. 125 v. DC West. Gen. with 2300 v. 3 ph. 60 cy. 1200 rpm. West. Motor including starting equipment and DC switchboard.

1—200 kw. West. 600 v. DC 900 rpm. Generator direct driven through common shaft by 1—290 HP 440 v. 3 ph. 60 cy. Westg. Syn. Motor.

A.C. GENERATORS

62½ KW Westg. 3 ph. 60 cy. 240/440/2300 v. 1200 rpm.

125 KVA New American Electric 480 v. 720 rpm. type OG-56.

125 KVA West., 220/220/440 v. 3 ph., 60 cy., 327 rpm.

250 KW Al. Ch., 480 v., 150 rmp. 3 ph.

360 KVA West. 220 v., 3 ph., 60 cy., 360 rpm.

SPEED REDUCERS

1—36 HP Cleveland Model 150, size 900 AT, ratio 43:1.

1—40 HP W. A. Jones 480 rpm. ratio 9.143:1.

2—50 HP W. A. Jones 575 rpm. ratio 9.143:1.

3—50 HP Niles Bement Pond double reduction, ratio 10:1.

2—50/150 HP Niles Bement Pond double reduction, 35 rpm. low speed, 70 rpm. high speed, 360/720 rpm. ratio 10:1.

1—75 HP W. A. Jones 875 rpm. ratio 9.143:1.

2—75 HP Niles Double Reduction 350 rpm. ratio 10:1.

1—100 HP W. A. Jones 1150 rpm. ratio 9.143:1.

2—100 HP Niles double reduction 550 rpm. ratio 10:1.

1—125 HP Niles double reduction 600 rpm. ratio 10:1.

1—125 HP Nuttal, single reduction, ratio 1.6:1 450 rpm.

1—150 HP Nuttal, single reduction, ratio 1.6:1.

3—150 HP Niles double reduction 720 rpm. ratio 10:1.

1—175 HP Jones 1750 rpm, ratio 9.143:1.

2—180 HP Cleveland size 1000 AT ratio 9-2/5:1.

2—200 HP Niles Bement Pond double reduction, 860 rpm. ratio 10:1.

1—225 HP Nuttal, ratio 1.6:1.

2—300 HP Niles Bement Pond double reduction, 1150 rpm. ratio 10:1.

1—300 HP Nuttal, ratio 1.6:1.

2—400 HP Niles Bement Pond double reduction, 1750 rpm. ratio 10:1.

1—400 HP Nuttal, ratio 1.6:1.

Large Stock—CIRCUIT BREAKERS—METERS — CURRENT AND POTENTIAL TRANSFORMERS—POTHEADS—RELAYS — METERS — SAFETY SWITCHES — DISCONNECT SWITCHES — U-RE-LITES — PULLEYS—REACTORS.

WRITE, WIRE OR PHONE YOUR ELECTRICAL REQUIREMENTS—SEND FOR STOCK LIST.
LIST YOUR IDLE EQUIPMENT WITH US.

DUQUESNE ELECTRIC & MFG. CO.
PITTSBURGH 6, PA.

FOR SALE

Power plant equipment. Steam, Diesel, electrical, boilers, engines, turbines, generators, new or used.

PENN MACHINERY COMPANY
Jackson, Miss.

FOR SALE — PULVERIZERS

2—Aero Foster Wheeler Size F 5000# Coke per hour each, with 50-H.P. Ty F.T. G.E. Motors 440-volt 60 cycle 95% New $3,750.00 each.

BEVIS MACHINERY COMPANY
585 S. Santa Fe Ave. Los Angeles 13 Cal.

DIESELS

2—150 H.P.
A.C. GENERATOR SETS
DIRECT CONNECTED TO
MODEL "E" BUCKEYES
400 R.P.M.

ROBERT SCHOONMAKER
Port Washington, Long Island, N.Y.
Phone Roslyn 1220

COMPLETE POWER PLANT

750 KW General Electric Turbo Generator, 3/60/480, direct connected Curtis Turbine, two 500 HP Sterling water tube boilers, stokers, coal handling equipment, superheaters, economizers, soot blowers, etc.

Plant housed in buildings fully intact.

Specifications on request.

MORSE BROS. MACHINERY CO.
P. O. Box 1708 Denver 1, Colorado

CHICAGO'S LARGEST STOCK GUARANTEED EQUIPMENT

MOTOR GENERATOR SETS

KW	Make	DC	Volts	AC Volts
1500	Wtg.	250	Syn.	3/60/2300
1200	G.E.	280	Syn.	3/60/4100
1000	G.E.	250	Syn.	3/60/4150
1000	G.E.	600	Syn.	3/60/2300
1000	Wtg.	275	Ind.	3/60/4100
750	Wtg.	275	Syn.	3/60/440
235	Wtg.	125	Syn.	3/60/2200
225	Ideal	125	Syn.	3/60/2200
200	Elliott	125	Ind.	3/60/2200
150	Al. Ch.	250	Syn.	3/60/2300
100	Al. Ch.	125	Syn.	3/60/440
100	Wtg.	250	Ind.	3/60/440
100	Wtg.	250	Ind.	3/60/2200
100	G.E.	250	Ind.	3/60/2200
75	G.E.	250	Ind.	3/60/440
75	G.E.	125	Syn.	3/60/220
60	Al. Ch.	110	Ind.	3/60/2200
50	G.E.	250	Ind.	3/60/440
25	G.E.	230	Ind.	3/60/220
22½	G.E.	125	Ind.	3/60/220
15	Ideal	220	Ind.	3/60/220
10	G.E.	115/230		Balancer set
7½	G.E.	60	Ind.	3/60/440
7½	Jen.	115/230		Balancer set
5	Roth	125/250		Balancer set
3½	G.E.	230	Ind	3/60/220
3	Lincoln	115	Ind.	1/60/220
3	Lincoln	115	Ind.	1/60/220
3	Westg.	25	Ind.	3/60/220
2½	Acme	45	Ind.	3/60/220
2¼	Wotton		Ind.	1/60/110/220
2.4	Lincoln	80	Ind.	3/60/220
3 HP	Roth	110		2 KVA 1/60/110
2	El Sp.	750	Ind.	3/60/440
1	Holtz. C	65		220 D.C.
.5	Rob. M.	115		Variable voltage
.378	G.E.	110	Ind.	1/60/110
.250	Robbins	125	Ind.	1/60/125
.250	Roch.	120	Ind.	1/60/110/220
.2	G.E.	6		115 v. d.c.
.2	G.E.	6	Ind.	1/60/110/220

FREQUENCY CHANGERS

1400 HP General Electric type ATI-24-1250M-300, form C, 3 ph., 60 cy., 460 volt, 300 RPM, 1570 amps., 1250 KVA, 0.9 P.F. 50° synchronous motor with amort. wdg.; dir./conn. to 1000 KW General Electric type ATI-10-1250M-300, 3 ph., 25 cy., 460 volts, 300 RPM, 1570 amps., 1250 KVA, 0.8 P.F. 50° A.C. generator with amort. wdg., with 33 KW G.E. 125 volt direct connected exciter. (This is a three brg. unit suitable for operation from either end.) 40 KW Howell, SR-5454, 3 phase, 60 cycle, 440 volt to 40 HP 3 phase, 25 cycle, 40 volt, SC-443, .8 p.f., 750 GM, 4-brg. set.

SLIPRING MOTORS
3 Phase, 60 Cycle

Qu.	HP	Make	Type	Speed
2	2500	G.E.	MT	253
1	1000	Westg.	CW	450
1	1000	Westg.	HR	360
1	1000	G.E.		400
1	850	Allis. Chal.		1180
1	800	Westg.	CW	360
2	800	Westg.	CW	507
1	800	Westg.	CW	900
1	750	Allis. Ch.		440
1	750	G.E.	I-P	900
1	700	G.E	MT-10	710
1	600	Westg. with	drive	350
1	600	Westg.	CW	390
1	500	G.E.	MT412	435
1	500	G.E.	MT412	450
1	450	G.E.	MT412	600
1	400	Westg.	CW	435
1	400	Allis Chal.		600
1	400	G.E.	I-M	720
1	400	G.E.		1200
1	400	G.E.	IP	1800
1	350	Allis Chal.		300
1	350	G.E.	MT	300
1	350	G.E.	I-M	900
1	300	G.E.	I-24	293
1	300	Westg.	CW	400
1	300	G.E.	I-P	450
1	300	G.E.	MT-410	450
1	300	Westg.	CW	500
1	300	G.E.	I	514
1	300	G.F.		720
1	250	Westg.	CW	435
1	250	Cr. Wheeler	SR27QB	600
1	250	G.E.	IM	435

SQUIRREL CAGE MOTORS
3 Phase, 60 Cycle

Qu.	HP	Make	Type	Speed
1	1000	G.E. 2200 v	K	509
1	700	G.E. 2200 drip-proof conn.	KF	1800
1	600	Fair. Morse	H2	212
1	500	G.E.	IK	1200
1	500	Westg.	CS	1750
1	400	Allis Chal.		600
1	400	G.E.	I-M	950
1	400	G.E.	I-K	1800
3	250	Westg.	CS	350
1	250	Ideal	A	1200
4	250	Fair.Morse	BB	1800
1	225	G.E.	I-E	1800
1	225	G.E.	FT	3600
1	200	Allis Chal.	AN	347
1	200	Fair. Morse		514
1	200	Westg.	CS	600
1	200	G.E.	IK	600
1	200	G.E.	KT566	720
3	200	G.E. 2200 v.		1800
3	200	Fair. Morse	BB	1800
1	200	Westg.	CS	3600
2	200	G.E.	KTP	3600
1	150	Allis Chal.		570
1	150	G.E.	IK	600
1	150	Westg.	CS	1800
2	120	G.E.		720
2	150	G.E.	I-K	720
1	150	Allis Ch.		850
1	150	G.E.	K-558	900
1	150	Westg.	CS	1800
4	125	G.E.	KT	720

TRANSFORMERS

No.	KVA	Make	Type	Pri.	Sec.
2	200	G.E. 3 ph. Auto.	HT	4000Y	2300Y
1	100	G.E. 3 ph. 25 cy.	HT	9000	230
1	75	Darling Auto H.	182	10	250
2	75	West.	S	3810	244/122
3	75	West.	SK	3810	244/122
1	30	Kuhlman 3 ph.		210/220/230	55/100
1	15	Ft. W. A.		1050/2100	2200/288
1	10	Moloney	HE	1100/2200	220/440
1	7½	G.E.	H	1100/2200	244/488
1	7½	G.E. 3 ph.	HT	2300/3810	220/440
1	7½	Pitts.	HE	2200	110/220
1	7½	G.E. 3 ph.	HT	6600	230
1	6	Sorgel ? ph.	SO	140	228
1	5	G.E.	H	1100/2200	220/440
1	3	Moloney	HF	2200	110/220
1	3	Moloney	HE	1150	115/230
8	3	G.E.	H	220/440	55/110
1	1½	Al. Ch.		2200	110/220

BOILER

300 HP Keeler, reinsurable 200 lbs. with chain grate stoker, can release at once.

3—100 KVA New Moloney, type CL, single phase, 60 cycle, 33000 volts primary, 480/220 volts secondary.

TURBINE

100 HP Terry steam turbine, 125 lbs. for 3 phase, 60 cycle, 240 volt operation, 3600 RPM, fine condition.

Have large stock other sizes and speeds. Motors, Generators, Pumps, Transformers. NEW factory distributors, can furnish many new items from stock.

CHICAGO ELECTRIC CO. 1320 W. CERMAK RD. CANAL 2900 CHICAGO 8, ILL.

70-300 AMP. MOTOR DRIVEN WELDERS

25 — WESTINGHOUSE PORTABLE 45 HOBART STATIONARY

AVAILABLE FOR IMMEDIATE DELIVERY. ALL USED ON ONE CONSTRUCTION JOB—ONE YEAR OLD. EACH COMPLETE WITH 125 FEET OF WELDING CABLE, HOOD AND ELECTRODE HOLDER.

BOILERS

4—1010 HP Heine Watertube Boilers complete with Superheaters, Bethlehem Dahl Oil Burners, all valves, piping and fittings.
2—316 HP Heine Watertube Boilers 160 lbs. pressure.
2—684 HP Edgemoore Waste Heat Boilers 200 lbs. pressure, ASME with superheaters and economizers.
2—440 HP New Westinghouse single retort moving grate stokers, complete with hydro feed drives, blowers and all accessories. Will operate at 200% of rating. Never installed.

TURBO-GENERATOR

6250 KVA Westinghouse Turbo-Generator Set: Turbine 3600 RPM, 200 lbs. pressure, 125° Superheat, complete with condenser, Pump and Air Washer. Generator: 6250 KVA 3 Phase 60 Cycle 2300 Volt 3600 RPM with turbo exciter and Motor Generator Exciter.

WATER WHEELS and GENERATORS

2—45" HERCULES Cylinder Gate Type B Water Wheels. Complete with Governors, pumps, and tanks. Each direct-connected to a WESTINGHOUSE ELECTRIC Vertical Generator 800 KVA, 3 ph., 600 V, 40 cy. 150 R.P.M.

SPEED REDUCERS

6—Jones Herringbone 50 HP, Ratio 93.5 to 1.

TURBO-CENTRIFUGAL PUMPS

Terry Steam driven Turbine centrifugal pump, type GF, turbine 710 H.P., 145 lb. steam pressure, 60 lb. back-pressure, 3581 RPM direct connected thru Gear Unit 1000 RPM; type U Allis Chalmers Centrifugal Pump 18" x 18", 13,000 GPM at 170' head, 1000 RPM.

1—Lawrence Machine 3 stage pump 550 GPM, 418' head. With Elliott Turbine, 200 H.P., 2400 RPM, 170 lbs. initial, 12 lbs. back pressure.

1—Lawrence Machine 8" Circulating Pump. With Lee Turbine, 50 H.P., 2100 RPM, 150-250 lbs. initial, 10 lbs. back pressure.

1—Lawrence Machine 6" Circulating Pump. With London Steam Turbine, 40 H.P., 2200 RPM, 150 lbs. initial, 10 lbs. back pressure.

1—Lawrence Machine 5 stage pump 150 GPM, 635' head. With Lee Turbine, 80 H.P., 2600 RPM, 200 lbs. initial, 10 lbs. back pressure.

1—Lawrence Machine 5 stage pump 200 GPM, 635' head. With Lee Turbine, 85 H.P., 2650 RPM, 175 lbs. initial, 10 lbs. back pressure.

STEEL STORAGE BINS

Sizes up to 35,000 cbft.

CENTRIFUGAL PUMPS

1—Lecourtenay 12" Iron Casing Motor Driven Centriugal Pumps, type 12BT8, 5,000 GPM at 148' H., Direct connected to G.E. 250 HP. Motor, type IE15 form K, 440, 60, 3, 1760 RPM.
8—Gould Centrifugal Pumps 270 GPM, 30' H. Direct Driven by 5 H.P. A.C. Motor.
Cameron Centrifugal Purchased New 1923. Bronze fitted, mounted on common sub-base for motor drive—
1—Size 14—700 RPM 4700 GPM 35' head 60 H.P.
1—Size 14—720 RPM 5500 GPM 30' head 75 H.P.
1—Size 16—350—RPM 3500 GPM 45' head 125 H. P.
All Pumps Tested Hydrostatically for 125 lbs.
All Double Suction Volute, Gate Valves Attached.
1—Gould Triplex Pump 5 x 8.

CONVEYORS AND BUCKET ELEVATORS

MISCELLANEOUS

FEEDWATER HEATER: 5,000 HP. Cochrane open type.
OVERHEAD CRANES: One 25 Ton overhead hand operated.
One 15 Ton overhead 50' span traveling crane, electric lift; hand travel.

Heat and Power COMPANY

45 BOND ST. • ALGONQUIN 4-3874 • NEW YORK 12, N. Y.

SYNCH. CONVERTERS

500 KW AL-CH. 250 D.C. 2300/4000 A.C. 1200 RPM
500 KW WEST. 250 D.C. 2300/4000 A.C. 1200 RPM
300 KW G.E. 250 D.C. 2300/4000 A.C. 1200 RPM
300 KW G.E. 600 D.C. 2300/4000 A.C. 1200 RPM
150 KW WEST. 250 D.C. 2300/4000 A.C. 1200 RPM

MOTOR GENERATORS

300 KW G.E. SYN. 250 V. 2300/4000 A.C. 12 RPM
200 KW G. E. IND. 600 V. 2300/4000 A.C. 1200 RPM
200 KW RW SYN. 250 V. 2300/4000 A.C. 900 RPM

Each unit listed above is owned by us and is available now for immediate purchase.

WALLACE E. KIRK CO.
Incorporated
502 Grant Building Pittsburgh, Pa.

BOILERS

NEW and USED

All makes & sizes for prompt shipment

2—400 H.P. B. & W. Stirling Type Boilers 200#
2—250 H.P. Scotch 125#
1—300 H.P. Keeler W. T. 200#
1—275 K.V.A. Engine Generator Unit
12—Various sizes Vertical Fire Tube boilers
Feed Boiler Heaters

J. F. DAVIS CO.
122 S. Michigan Ave. CHICAGO

DIESELS

100 H. P.
BUCKEYE
"J" — 600 RPM
65 KW, A.C.
1940

ROBERT SCHOONMAKER
Port Washington, Long Island, N.Y.
Phone Roslyn 1220

CONDENSERS

2—1150 sq. ft. Worthington Surface Condensers, Admiralty tubes; with pumps

PUMPS—Large stock centrifugal—turbine—piston

STEAM PUMPS—Duplex-Simplex Reconditioned and guaranteed

BOILERS—stacks—Engine Generator

LOU COHEN & CO.
1030 N. 6th St. St. Louis 1, Mo.

1—440 HP Elec. Machinery, 3-60-440V, 900 RPM, two bearing syn. motor
1—400 HP Westinghouse, type CW, 3 ph. 60 cy. 440V. 450 RPM slip ring motor
1—300 HP General Electric, 3 phase, 60 cycle, 440 volt, 360 RPM, type MT 412 slip ring motor
1—275 HP, Allis-Chalmers, 3 phase, 60 cycle, 440 volt, 1175 RPM slip ring motor
1—200 HP, Allis-Chalmers, 3 phase, 60 cycle, 440 volt, 1150 RPM slip ring motor
1—150 HP, General Electric, 3-60-440V frames 17A 360 RPM slip ring
1—150 HP Westinghouse, 2 ph, 60 cy, 440V frame 1000, CW. 390 RPM slip ring
1—100 HP General Electric, 3-60-440V, 495 RPM, MT 562 slip ring
2—100 HP General Electric, type I, form K, 3-60-220V 575 RPM

2—800 HP, 3 PH, 60 CY, 6600 V Westinghouse, type CW, slip ring 507 RPM mill type motors with liquid slip regulators.

1—150 HP DC Westinghouse type SK, frame 666.3, 600 V. 360/720 RPM ped. type mill motor, #4798360.

1—100 HP Westinghouse, type CCL, 3 ph. 60 cy, 2200V, 1750 RPM, Squirrel Cage
1—100 HP Allis-Chalmers, type ANY, 3 ph. 60 cy, 220V, 580 RPM slip ring
1—100 HP General Electric, 3 ph, 60 cy. 4000V, 720 RPM syn., type TS with direct connected exciter
2—100 HP Crocker Wheeler, size 2AQ, 3 ph, 60 cy, 440V, 385 RPM slip ring
1—100 HP Westinghouse, type CS, 3 ph. 60 cy, 440V, 1750 RPM sq. cage
1—75 HP, General Electric, 3 phase, 60 cycle, 440 volt, 450 RPM, type I, form M, slip ring motor
1—75 HP Allis-Chalmers, 3 ph, 60 cy, 440V, 450 RPM slip ring
1—75 HP Fairbanks-Morse, type H, frame 165C, 3 ph, 60 cy, 550V, 900 RPM Squirrel Cage
1—75 HP Lincoln, type IQ, 2 ph, 60 cy, 440V, 600 RPM Squirrel Cage
1—75 HP Allis-Chalmers, 3 ph, 60 cy, 440V, 600 RPM slip ring
2—75 HP, Fairbanks-Morse, 3 phase, 60 cycle, 2200 volt, 1800 RPM, slip ring motors
1—60 HP Lincoln 3-60-220V frame IXM, Sq. Cage, 900 RPM
1—60 HP General Electric, 3-60-440V, 720 RPM, type I, form K
1—60 HP General Electric, 3-60-440V, 1750 RPM, type I slip ring
1—60 HP, General Electric, 3 phase, 60 cycle, 440 volt, 600 RPM, type MT 556 slip ring motor
1—50 HP General Electric 3-60-220V, 1150 RPM, type I, slip ring

2—G.E. factory built syn. M-G sets 230 KW, 125 V, 600 RPM generator driven by 335 HP, 4600 V syn. motor complete with starting equipment and panels.

1—50 HP Triumph 3-60-440V, type C12, 1150 RPM, slip ring, rotor & stator rewound
1—50 HP General Electric, 3-60-440V, 900 RPM, type I-M, slip ring
1—50 HP General Electric, 3-60-440V, 720 RPM, type IK, Sq. Cage
2—50 HP Allis-Chalmers, 3-60-440V, 690 RPM slip ring
1—50 KW, Allis-Chalmers, factory-built, 3 bearing M-G set, 125 volt DC, driven by 75 HP, 3 phase, 60 cycle, 220 volt, 1165 RPM motor
1—50 HP General Electric 3-60-440V, 690 RPM, MTS 46, slip ring
1—50 HP Ideal 3-60-440V, 580 RPM, type AV, slip ring
1—50 HP Wagner 3-60-440V, 495 RPM, type BM, Sq. Cage
1—50 HP Allis-Chalmers, 3-60-440V, 490 RPM, Sq. Cage
1—50 HP General Electric 3-60-440V, 490 RPM, type I-M, slip ring
1—50 HP Westinghouse CS 2-60-440V, 420 RPM, Sq. Cage
1—50 HP Allis-Chalmers, 3 ph, 60 cy, 550V, 860 RPM Sq. Cage
1—50 HP General Electric, type I-M, 3 ph, 60 cy, 440V, 720 RPM slip ring
1—45 KVA Fairbanks-Morse, 3 ph, 60 cy, 220V, 1200 RPM alternator
2—30 HP Fairbanks-Morse, 3 ph, 60 cy, 220V, 3600 RPM, type HO, frame 12B ball bearing

2—drag generators, 15 KW. Westinghouse, SK111, 125 V. 450/1800 RPM gear head, ratio 10 to 1, used a few months.

2—175 HP, 230V, DC Westinghouse, type SK, 150 to 550 RPM
1—100 HP General Electric, type CD, fr. 123, 230V, 1200 RPM
1—60 HP Westinghouse, type SK140L, 115V, 1150 RPM vertical
1—50 HP Westinghouse SK200, 230V, 250/900 RPM
2—40 HP, G. E., 3 ph, 60 cy, 440V, 435 RPM, type 1-13A

25 CYCLE MOTORS

1—50 HP Westinghouse 3-25 cy-440V, 720 RPM, type MS, Sq. Cage
1—50 HP General Electric, 3-25 cy-440V, 700 RPM, type I-M, slip ring
1—40 HP Westinghouse 3-25 cy-440V, 730 RPM, type CI, frame 753A slip ring crane
1—35 HP Allis-Chalmers 3-25 cy-440V, 720 RPM, slip ring
1—30 HP Westinghouse 3-25 cy-440V, 720 RPM, CS, Sq. Cage

The Wente Electric Co.

Hamilton, Ohio

REBUILT MOTORS & GENERATORS SINCE 1906

MOTORS • GENERATORS • TRANSFORMERS

Prices on Application

Rebuilt Motors

3 PHASE, 60 Cycle, 220/440 Volts

HP	Make	Type	RPM
400	General Electric	I-K	900
400	General Electric	I-K	900
350	General Electric	I-K	900
250	General Electric	I-K	900
200	General Electric	KT357	1800
200	General Electric	I-K	900
200	General Electric	I-K	720
150	General Electric	KT357	1200
150	Westinghouse	CCL	900
125	General Electric	KT347	1800
100	General Electric	KT347	1200
75	General Electric	KT543	1800
60	General Electric	KT343	1200
60	Burke	EM7	870
60	General Electric	KT346	900
50	Westinghouse	CS	1800
50	General Electric	KT327	1800
50	Westinghouse	CS-646A	870
50	Reliance	*IJ	1800
40	Westinghouse	CS	1800
40	Westinghouse	CS	1800
40	General Electric	KT323	1800
40	General Electric	KT323	1800
40	General Electric	KT523	1800
40	Burke	EM45	1200
35	Lincoln	D-411	1800
30	Westinghouse	CCL	720
30	General Electric	KT332	1160
*30	Armor	A	850
25	General Electric	I	1150
*20	Armor	ET-416	850
*20	Fairbanks Morse	H	900
*20	General Electric	KG-405	880
20	General Electric	KG-404	1150
20	General Electric	KT312	720
20	Fairbanks Morse	H-12A	850
15	Crocker Wheeler	1100	560
15	Crocker Wheeler	114Q	1800
10	Star	AX	3500
10	Century	SC	685
10	General Electric	KT312	900
10	Lincoln		1200
7½	Fairbanks Morse	B	1200
7½	General Electric	KT954	1200
7½	Wagner	14VBP	1800
5	Westinghouse	CCL	3400
3	U. S.	FRB	1800
3	Fairbanks Morse		900
*1	Master	PA	3425

SLIPRING MOTORS

60 Cycle—3 Phase—220/440 Volts

HP	Make	Type	RPM
500	Westinghouse	CW	575
400	General Electric	I-M	900
250	General Electric	I-M	900
250	Allis Chalmers		505
200	General Electric	I-M	900
75	General Electric	MT-546	900
50	Westinghouse	CW	700
40	Westinghouse	CW-748	690
40	Westinghouse	CW-748A	690
40	Westinghouse	CW-748	690
40	Westinghouse	CW-748	690
40	Westinghouse	CW-748	690
30	Westinghouse	HF	1745
*20	Westinghouse	CW-644C	575
20	General Electric	MT-332	545
15	General Electric	I-M	900
15	General Electric	MT-322	855
13	Sachsenwerk	D7318	850
11	General Electric	ITC-5008	820
10	General Electric	MT-303Y	1800

* Ball bearing. ** Sealed sleeve bearing.

If You Use 25-CYCLE MOTORS

write for our

NEW LIST

from plants just purchased

MOTORS

25 cycle—3 phase—2200 volts

100 H.P., General Electric, type KT558, 750 rpm, serial number 5227257, ball bearing.
100 H.P., Allis Chalmers, type AR, ball bearing, 1500 rpm, serial number 42209K426N-1-1.
150 H.P., General Electric, ball bearing, type KT557Y, 1500 rpm, serial number 5269756.

MOTOR GENERATOR SETS

1—125 KW Ridgeway 250 V. DC. 1200 RPM Motor 3/440/60/1200 Complete.
1—100 KW Westinghouse Synchronous-Generator 250-275 V. DC—Motor 3/60/2300/900 RPM complete with panels.

FREQUENCY CHANGER SET

1—1250 KVA Gen. Elec. Synchronous—motor 3/25/2200 750 RPM direct connected to Generator 362½/440 V. Complete with exciters and panels.

25 CYCLE GAS GENERATOR SET

70 HP, 4 cyl. 500 RPM Gas or Gasoline Engine direct connected to 45 KW Gen. Elect. Generator—25 cy. 3 ph. 220/440 V. 500 RPM—Price $2,750.00 on Foundation—Buffalo.

TRANSFORMERS

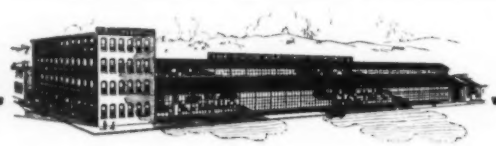
3—150 KVA Moloney Electric Co. 2200 v. Primary—220/440 v. Secondary 1 phase 60 cycle with taps.
3—200 KVA, Westinghouse Electric Co. 2400 volts primary—480 volts secondary 1 phase 60 cycle with taps.

200 KW. 25 CYCLE, M. G. SET

200 KW. Gen. Elect. Generator, 240 V. DC. 750 RPM. Type MPC. on Factory Base direct connected to 300 HP. Gen. Elect. Type I Form K. 3/25/440 V. 750 RPM. Complete with Motor Starting Equipment and DC. Panels.

ERIE ELECTRIC CO., INC.

124 CHURCH ST. BUFFALO, N. Y. CL. 4758



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120,000 SQ. FT. OF WAREHOUSE SPACE . .

. . . Housing our Complete Rebuilding Facilities . . . Also a wide range of Electric Motors and Power Plant Equipment

2—MOTOR-GENERATOR SETS

G.E. Type "M.P.C." 500 KW 250 V. Compound-Interpole, d.c. to G.E. Type "ATI" 710 HP, 750 RPM 6200 Volt, 25 CY. Synchronous Motors.

We pay cash for electric motors and generators

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933-943 HARRIET ST. Phone MA. 3024 CINCINNATI 3, OHIO

TURBO GENERATORS

1—937KVA Gen. Elec. with Wheeler condensor
1—500KW Allis Chalmers Moore non-cond.
1—500KW Gen. Elec. non-cond.
1—300KW Gen. Elec. cond.

ROTARY CONVERTERS

1—1500KW 250V Westgh complete
2—1000KW 250V Westgh complete

The above are just a few of the thousands of items we have in Motors, Generators, Turbo Generators, Engine Generators, Motor Generators, transformers, Circuit Breakers, etc. Please send us your inquiries.

What have you for sale?

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Power Plant Equipment Company

8403 Hegerman St., Phila. 36, Penna.

FOR SALE

1—50 KVA 2300-440-220 V. Gen. D/C Engine
1—250 & 187 KVA AC Gens. D/C Unaflows
1—600 HP Syn. Motor; 65 HP Loco. Boiler
1—750 HP Diesel; 125 KW Motor Gen. Set
5—320 HP Heine 200# W. T. Boilers
1—60 KW, 250 V. DC Gen. D/C Engine
1—100 KVA AC Gen. D/C Full Diesel
2—78x18 ASME Code 150# HRT Boilers

H. & P. MACHINERY CO., 6719 Etzel, St. Louis

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Switchboard and Portable type A.C. & D.C. all types electric meters. Ship to us any meters you have for repairs via freight or express. We shall gladly submit estimate.

Philadelphia Transformer Co.

2829 Cedar St. Phila., Penna.

50 YEARS OF SERVICE

REQUEST FOR MODERN MACHINERY

750 KW to 5000 KW turbo generators—300 HP to 1000 HP Diesel engine generators—400 HP to 1000 HP 250# or better boilers.

We Solicit the Listing of your Idle Equipment for Resale

WORTHY USED POWER UNITS—WORTHWHILE BARGAINS

TURBOS

2—6250 KVA Westinghouse 76 CW frame turbo generator 60/3/2300V/3600 rpm. Well maintained, heavy duty unit equal to new.

1—5000 KW G.E. Curtis 5 stage Cond. 60/3/2300V/3600 rpm, 175/200# 100° S.H. 28" Vac. complete. Also steel structure 35'6" x 64' x 27' high, 15 ton 33' crane.

1—2000 KW Wemco 60/3/460V turbo generator, 180# surface cond.

1—1250 KW Wemco turbo generator AC 60/3/150V 120° S.H. 3600 rpm. 480/500° T.T. BLEEDER 15,000# at 10-25# gauge.

1—1000 KW Wemco-Parsons low pressure low speed 125/150#/60/3/2300V/1800 rpm. complete. Surface condenser. Rolling Mill turbine.

1—750 KW Allis-Chalmers 60/3/2300V/3600 rpm. 300#, 550° T.T. with surface condenser, all auxiliaries. 1944 inspected.

1—940 KVA Wemco 60/3/2300V/6600 rpm, 250# 550° T.T. surface condenser.

1—750 KW Allis-Chalmers 200# 60/3/2300V surface condenser direct connected exciter, complete.

3—400 KW Wemco Bleeder turbos, 60/3/220/3600/150#/100°S.H. Bld. 10# G. complete.

ALSO

2—300 HP, 1—500 HP Diesel engine generators.

STEAM ENGINE SETS

100-1000 HP.

BOILERS

1—100,000/120,000# steam generation plant, complete. Superheater Economizer, Steel encased boiler, with 14 retort underfeed stoker, 100,000# continuous.

4—1000 HP B&W Stirling type ASME code boiler, 200# with underfeed stokers.

1—750 HP 170# Edgemoor waste heat boiler. ASME code.

1—612 HP 200# 125° S.H. Stirling type boiler. ASME code.

3—522 HP 180# Heine boiler, 150° S.H. ASME code.

1—444 HP Union Iron Works 200# 125° S.H. boiler, ASME code.

1—500 HP 170# 125° S.H. ASME code boiler, Combustion Eng. type E stoker.

2—400 HP Springfield boiler, 180# with stoker, ASME code.

2—365 HP Edgemoor 200# boiler, 100° S.H. ASME code ram type stoker.

3—316 HP Heine horizontal 170# waste heat boiler.

1—313 HP 250# Edgemoor boiler, 125° S.H. with stoker.

2—300 HP Stirling B&W ASME 170#—100°.

2—200 HP Erie City, HRT 150# new in 1929; stoker equipped.

2—150 HP Casey Hedges Scotch Marines 150#, stokers & stacks.

POWER PLANT EQUIPMENT CO., Inc.

39 Cortlandt Street
New York, N. Y.

A C TURBINE UNITS

6250 KVA G.E., 2300 V., cond.
3750 KVA Wghse. 600 V. BLEEDER.
3125 KVA G.E., 4100/2300 V. cond.
3125 KVA G.E., 480 V., BLEEDER.
2500 KVA G.E., 2300 V. cond.
2500 KVA Al. Chal. 440 V. cond.
1875 KVA G.E., 2300 V. cond.
1250 KVA (2) G.E., 2300 V. cond.
940 KVA Wghse. 6600 V. cond.
937 KVA G.E., auto BLEEDER, 2300 V.
937 KVA G.E., 2300 V. cond.
937 KVA Al. Chal. 2300 V. 300#.
780 KVA Al. Chal. 2300 V. cond.
750 KVA G.E., 2300 V. cond.
625 KVA Wghse. 2300 V. cond.
375 KVA G.E., 2300 V. cond.
312 KVA Elliott 480 v. cond.
150 KVA Wghse. 240 V. cond.

(NON COND.)

500 KVA Wghse. 480/240 V.
375 KVA G.E., 2300 V.
312 KVA C.W.—Moore, 450#, 240 V.
125 KVA G.E., 480/240 V.
75 KVA Al. Chal. 240 V.
190 HP Wghse. 375# Turbine.
150 HP Terry. 225# Turbine.

BOILERS

850 HP B&W W. T. Boiler 250# with Riley Stoker.
749 HP (2) Edgemoor, 200#
728 HP Erie City, Ver. 200#.
612 HP Sterling 250# Chain Gr. Stoker.
522 HP Kidwell 207#, 3 drum.
471 HP Erie City Ver., 160#
396 HP B. & W., 160#
300 HP (2) Union Iron Wks. Cross drum 175#
287 HP (2) B&W 160#
259 HP (3) Wicks ver.; 160# pulverizers.
255 HP Casey-Hedges 160#
Two 78" x 18' HRT 125# pulverizers.

DIESEL ENGINE SETS

375 KVA Wghse.—Busch Sulzer
312 KVA G.E.—Anderson
312 KVA G.E.—McIntosh Sey.
200 KVA G.E.—Busch Sulzer.
118 KVA (2) Fairbanks 32E12.
125 KVA Ideal-Primm
105 KVA Ideal-Primm
100 KVA C.W. Bessemer
90 KVA (4) F.M.—F.M. "VA"
75 KVA Al. Chal.—International

DIESEL ENGINES

225 HP Chicago pneumatic 6 cyl.
80 HP (3) Fairbanks Style V. A.

SPECIAL

750 KVA G.E. 3-60-2300 V. turbo unit; surface condenser.
612 HP Sterling 250#; Cox Chain grate stoker.
522 Kidwell 207# with Fire-rite stoker.

STEAM ENGINE SETS (A C)

675 KVA Burke—24 x 36 Nordberg Unif.
480 KVA Al. Chal.—Corliss 4 V.
375 KVA G.E.—22 x 27 Erie Ball, 4 V
325 KVA A.C.—21 x 22 Skinner-Unif.
300 KVA G.E.—Ames UNIFLOW (Twin)
210 KVA G.E.—19 x 20 Skinner Unif
175 KVA Wghse.—Ames UNIFLOW.
150 KVA G.E.—16 x 16 Skinner S.V.

PUMPS (MOTOR DRIVEN)

8000 GPM Al. Chal. 132' head.
7500 GPM 80' head
5500 GPM Buffalo 50' head
3600 GPM 85' head
3250 GPM 425' head
3000 GPM 100' head
3000 GPM (2) 65' head
1390 GPM 231' head
1200 GPM Al. Chal. 65' head
1000 GPM Morris 255' head
725 GPM Wheeler 30' head
350 GPM 720' head

STEAM ENGINE SETS 250 V.

450 KW C. W.—Nordberg Unif.
400 KW G.E.—Ridgway 4 V.
300 KW G.E.—Skinner Unif.
250 KW C.W.—Skinner UNIFLOW.
150 KW G.E.—Erie Ball 4 V.
100 KW G.E.—Erie Ball 4 V.

AIR COMPRESSORS

2200 CFM Nordberg 100#, Steam and Motor Driven
1080 CFM Nordberg 85#—Motor
228 CFM Worthington 125#—Motor.

SYNCHRONOUS CONDENSER

5000 KVA Wghse. 3-60-2300/4000 V. 900 RPM, with starting apparatus.

GAS ENGINE UNIT

1000 KVA G.E. 3-60 2300 v.—1200 HP Rathburn Jones Gas Engine.

SLIP RING MOTORS

3-HP., 60-CY

HP	Volts	Make	Speed
900	2200	G.E.	900
500	2300	Whse.	514
450	2300	G.E.	600
400	2300	Whse.	1200
350	220-440	G.E.	1800
300	2200	G.E.	1800
200	2200	Whse.	514
250	2300	G.E.	600
250	440-550	G.E.	600
200	2200-550	G.E.	1800
200	2200-400	G.E.	600
150	440-220	G.E.	1800
150	440	G.E.	1800
150	550-2200	G.E.	1800
150	550	G.E.	720
125	440-220	G.E.	600
100	550-2200	G.E.	720
100	440-220	G.E.	1800
100	220-440	G.E.	720
100	220-440	G.E.	900
75	220-440	G.E.	900

SYNCHRONOUS MOTORS

3-HP., 60-CY

800	2200	Whse.	900
350	440-220	G.E.	900
300	440-220	Al. Ch.	600
200	2300-4000	G.E.	1200
110	440	Whse.	900
100	2300-550	Al. Ch.	1800
75	440-220	G.E.	720

PUMP

1—8" Dredge Pump 1880 GPM, 120' Morris Machine Works with direct connected Slip Ring Motor 125 HP, 600 RPM, G.E.

UNAFLOW ENGINE-GENERATOR SET consisting of:
Gen: 250 KW 200 RPM 250 volt direct connected to:
Eng: 23" x 24" Ames Unaflow 125/150# ga. non-condensing.
Very modern—practically new.

TRANSFORMERS

60 CYCLE

3—500 kva., G.E., type H, form KS, 13800-230/460
3—500 kva.,Whse., 22000-2300.
3—350 kva., G.E., type H-KD 13200-4600.
3—333 kva., G.E., type H-KDD 2400-400/230.
3—250 kva., Whse., 13,800-460.
3—200 kva., G.E., type H 10000-600.
3—200 kva., G.E., H-KD 6600-2300/4000Y., 25 cy.
3—175 kva., G.E., 4000-480.
3—150 kva., G.E., type H-KDD 13200-2300.
3—150 kva., Al. Chal., type OISC 10400-2400.
1—100 kva., Pittsburgh, type OISC 2400-240-120.
3—100 kva., G.E., type H 2400-240-480.
3—100 kva., G.E., type H-KDD, 6900/11950Y-230/115.
3—100 kva., Whse., 22,000-2300.
2— 75 kva., G.E., type HK, 2300-230/115.
3— 50 kva., Moloney, 2300-230/115.
6— 50 kva., Whse., type SK, 13800-240/120.
3— 50 kva., Whse., 22,000-2300.

LARGE OIL CIRCUIT BREAKERS

1—New 400 Amp. Type FK, 136-1328A, General Elec. 3PST, 25,000 Volt Oil Switch, Interrupting Capacity 125,000 KVA, complete CT's PT's, etc.
1—3000 ampere, type FK 25, General Electric, 3 pst, 600 volt

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
500	440/220	G.E.	IK	1200
550	440/220	G.E.	IK	900
400	440	G.E.	KTP	1200
400	2200	Whse	C.S.	1800
300	2200	G.E.	IE-K	1800
250	2200	G.E.	IK	900
250	2200	Whse.	CS	1200
250	440/220	G.E.	IK	1800
200	220/440	G.E.	IK	720
150	2200	Allis Ch.	AN	450
150	440/220	Whse.	CS	514
125	440/220	G.E.	KT	1800
100	2200	G.E.	IK	900
100	2200	G.E.	IE-K	1800
100	550	G.E.	KT	900
100	220/440	G.E.	KT	720
75	2200	G.E.	KT	900
75	2300	G.E.	IE-K	1800
60	550	G.E.	FT	3600
50	220/400	G.E.	K	1800

MOTOR GENERATOR SETS

2—150 kw, 125 v., 1200 rpm. Whse., conn. to 220 hp, 440/220 v., 3 ph., 60 cy., syn. very modern, practically new.
75 KW, 125 V. 1200 RPM Westinghouse Conn. to 112 H.P. 2300/440 V. 3 ph. 60 cy. Ind. motor.
1—75 KW 250 V. 1800 RPM, Cr. Wh., Type CUD con. to 100 H.P., 2200 V., 3 ph., 60 cy. syn.

A.C. GENERATORS

1—500 kva., 900 r.p.m., 2209 V. Whse. Condenser.
1—300 kva., 900 r.p.m., 240/480 V., G.E.
1—225 kva., 600 r.p.m., 2200-240 V., G.E.
1—110 kva., 900 r.p.m., 440 V., G.E.
1— 60 kva., 720 r.p.m., 240/480 V., G.E.
1— 25 kva., 3600 r.p.m., 220 V., G.E.

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HARRY J. RICE PRES.

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GOOD VALUES—ALWAYS

375 & 500 HP Fulton Diesel Generators.
300 KW Nordberg Diesel Generator.
250 KW Ingersoll Rand Diesel Generator.
200 KVA Fairbanks Morse "VA" Diesel.
125 and 225 KVA Worthington Diesels.
800 KW Rathbun Jones Gas. Eng. Gen.
2—80 HP 125 lb. Steel Cased HRT Boilers.
1—150 HP same as above. All good.
2—84" x 20' HRT Steam Boilers.
20 Ton American 100' Boom Guy Derrick.
1500 to 3000 CFM Motor Driven Compressors.
25 Ton American Steam Locomotive Crane.

Water Tube Boilers—Air Compressors
Steel Sheet Piling—Pile Hammers, etc.

Mississippi Valley Equipment Co.
507 Locust St. St. Louis 1, Mo.

STEAM PUMPING ENGINES

1—Snow 8 MGD C&FW cr. Com. Opp. Type Cond. 26x64x17x36, with waterworks type condenser.
1—Snow 6 mgd. C&FW Cr. Com. Opp. Type Cond. 20-40x14½x36, with waterworks type cond.
1—Allis-Chal. 4 mgd. cr. com. cond. Size 12x18x13x24. All fine cond.
1—Platt Iron Wks. Cr. Comp. C&FW Meyer Valve Gear Cond. 1000 GPM. Size 14x28x9½x18.

PUMP VALVES

Birsh Valves for all types of reciprocating pumps.

LARGE GATE VALVES

1—20" Rensselaer #13 Iron Body Bronze Mounted Hub End Gate Valve with 16" Iron Brass Lined Hydl. Cyl. with indicating Rod and Eyebolt. (old).

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2—480 H.P. DELAVERGNES
6 CYL. 15 x 18
TYPE V. G.—300 R.P.M.
DIRECT CONNECTED TO
2—300 KW. WEST. A.C.

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Modern Plant doing Modern Rebuilding
From 50 CFM to 2500 CFM

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Transformer Specialists
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METROPOLITAN PLUMBING SUPPLY CO., INC.

Power Plant Valves and Engineering Specialties for Oil, Steam, Gas, Air, Liquids and Chemicals.
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Large Complete Stocks ⅛" to 24"
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For Hourly Nation-wide Shipments
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NOW AVAILABLE! GUARANTEED!

HEAT EXCHANGER UNIT

Struthers Wells Type F construction welded steel gas cooler. Drawing #R-5644 Struther Wells Contains 100-2" O.D. #10 BWG seamless 12' steel tubes. Tubes-rolled into tube sheets.

Designed for 120# working pressure on shell & tube side.

PRICED FOR CLEARANCE

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BOWLING GREEN 9-8542

POWER EQUIPMENT COMPANY

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CONTROLS MOTORS
MOTOR GENERATOR SETS
AIR-OIL CIRCUIT BREAKERS
NEW REBUILT

154 ANDREWS STREET ROCHESTER 4, N. Y.
Telephone MAIN 568 or 569

ELECTRICAL EQUIPMENT — PROMPT SHIPMENT

SLIP RING MOTORS—3 ph. 60 cy.

HP	Make	Volts	RPM	Type
1500	Westgh.	2200	435	CW
500	G.E.	2200	435	MT 412
300	Westgh.	2200	495	CW
200	G.E.	2200	495	IM
200	G.E.	2200	240	MT 412
2-150/75	Westgh.	220/440/2200	590/290	CW
150	Westgh.	220/440/2200	590	CW
125	Al. Ch.	2200	435	ANY
150	Westgh.	220/440/2200	375	CW
100	Westgh.	220/440/2200	690	CW
100	Al. Ch.	220/440	575	ANY
75	Westgh.	220/440/2200	290	CW
75	Westgh.	220/440/2200	580	CW
50	G.E.	2200	900	IM
50/12.5	G.E.	2200	865/435	IM
37	Otis	220/440	1140	Int.
5-30	Westgh.	220/440	865	CW
30	F. M.	220/440	1150	Ball Brg.

SLIP RING—3 ph. 25 cy.

HP	Make	Volts	RPM	Type
100	G.E.	220/440	500	MI 108

SYN. CONDENSER

5000 KVA West. 2300/4000/3/60 900 RP M with 28 KW 125 v. Type SK dir. con. exciter. (Late Type)

SQUIRREL CAGE—3 ph. 60 cy.

HP	Make	Volts	RPM	Type
1000	G.E.	2200	514	KT
150	Westgh.	220/440	580	CCL
100	G.E.	220/440	1150	I K
2-50	Triumph	220/440	685	B
40	Westgh.	220/440	575	CS
40	Elliott	220/440	1150	
30	Al. Ch.	220/440	1150	AN
30	Al. Ch.	220/440	860	AN
25/7½	Cr. Wh.	2200	1150/585	119 AQ
25	Elec. Mchry	220/440	495	
15	Westgh.	220/440	965	CS Int.

TRANSFORMERS

KVA	Make	Pri. V.	Sec. V
3-500	G.E.	25000	2200
3-300	G.E.	25000/11000	110
3-50	G.E.	23000	2200
2-25	G.E.	2200	244/488
1-37½	West.	2300	460/230
1-25	Al. Ch.	2200	440/220
10-10	Westgh.	2200	122/244
35-7½	G.E.	2200/1100	122/244

DC MOTORS

HP	Make	Volts	RPM	Type
230	G.E. (Ser)	500	475	MD 109.5
175	Westgh.	250	320	S
175	G.E. (Ser)	250	475	MDS 109½
140	Westgh. (Ser)	500	515	MC 90
130	G.E. (Ser)	230	550	CO1812A
100	G.E. (Ser)	230	480	MD 108
100	G.E. (Ser)	500	650	CO 1812
100	G.E.	115	575	DLC
70	G.E.	230	800	CL
60	G.E.	230	600	CO 2507
40	Westgh.	230	550/1650	SK 150
30	Cr. Wh.	230	1750	CCM

SYNCHRONOUS MOTORS—3 ph. 60 cy.

HP	Make	Volts	RPM	Type
200	Westgh.	2200	900	.8 P.F.
150	G. E.	2200	900	ATI-.8 P.F.

AC & DC GENERATORS

200 KVA. 8 P.F. 160 KW 2400/3/60 720 RPM G.E.
150 KW 250 v. 450 RPM Westgh. Type 8
100 KW 250 v. G.E. 600 RPM
2—100 KW 250 v. Westgh. SK 900 RPM
75 KW 125 v. 700 RPM G.E. Type DLC
60 KW 275 v. G.E. 1150 RPM Type CL

SYN. MOTOR GENERATOR SETS

150 KW G.E. 250 v. 900 RPM cpd. interpole dir. con. 225 HP G.E. ATI 2300/4000 v. 3 ph. 60 cy. with swbds. Rebuilt—Ready for shipment.
100 KW Westgh. SK 250 v. 900 RPM dir. con. 150 HP G.E. 2200/3/60 ATI with swbds.
65 KW G.E. Type CL 275 v. 1150 RPM cp. wd. dir. con. to 100 HP G.E. Type I Form K. 2200/440/3/60 1150 RPM with panel and starting equipment.
25 KW G.E. Type RC 125 v. cp. wd. 1800 RPM interpole dir. con. 40 HP G.E. Type KT 220/440 v. 3 ph. 60 cy. 1800 RPM with starting equipment.

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600 amp. Lincoln 220/440 3 ph. 60 cy.
3—300 amp. Lincoln 220/440 v. 3 ph. 60 cy.
5—400 amp. Lincoln 220/440 v. 3 ph. 60 cy.

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1—300 HP F&M YVA with Generator
1—300 HP F&M YV with or without Generator
1—300 HP McIntosh with Generator
1—210 HP F&M Model 32 D with or without Generator
1—200 HP F&M YV with Generator
3—100 HP F&M YV with Generators
1— 75 HP F&M YVA with Generator
1— 75 HP F&M YV
1— 60 HP F&M YVA
1— 50 HP F&M YV
1— 80 1-65 1-55 HP Bruce McBeth Nat. Gas Engines
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Steam Generating Units 62½ KW up to 250 KW

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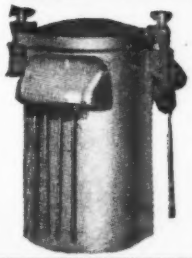

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G.P.M.	Head	Make	Type
9700	110′	Ing. Rand	Centrif.
6000	33′	LeCourtenay	Centrif.
3500	140′	Kingsford	Centrif.
2500	150′	Goulds	Centrif.
2400	55′	American	Centrif.
1100	220′	Allis-Chalm.	Centrif.
1500	180′	Penna	Centrif.
400	625′	LeCourtenay	Centrif.
250	525′	LeCourtenay	Centrif.
400	350′	Goulds	Triplex
300	500′	Goulds	Triplex
175	500′	Goulds	Triplex
500	175′	Blackmer	Rotary
450	231′	Kinney	Rotary
300	150′	Viking	Rotary
200	175′	Blackmer	Rotary
1000	460′	Knowles	Steam
750	460′	Snow	Steam
2000	50′	Lawrence	Sump
300	231′	Gardner	Plunger

M.G. SETS BOILER FEED PUMPS

K.W.	Make	Volts	Type
25	Geen Eng.	220	Belt Drive
100	Ames	240	dir. dr. Eng.
75	Ames	240/120	dir. dr. Eng.
17	Sturt Turb	110	Direct Drive
7½	Sturt. Turb	110	Direct Drive

MOTORS (D. C.)

100 Northwest 220 1750
25 Roth 230 1750

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5 to 1000 Gal. Steel Press.
15 to 300 Gal. Conden. Tanks

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Nash-Jenn Simp. Vac. Heat. 16000EDR
Condensation Units 100 to 250,000EDR

AIR COMPRESSORS

C.F.M.	Pressure	Make	Type
650	100	Laidlaw	Hor. Dup.
500	60	Ind. Rand	Steam
400	125	American	Horiz.
350	40	Worthing	Horiz.
250	100	Sullivan	Horiz.
125	100	Gardner	Vert. Dup.
173	100	Ing. Rand	Horiz.
28	5000	Norwalk	4-Stage

TURBO-CENTRIFUGAL BLOWERS

3000	16 lbs.	In. Rand	Motor dr.
3000	8 lbs.	In. Rand	Motor dr.
950	24 oz.	Spencer	Motor dr.
900	5¼ lbs.	In. Rand	Motor dr.
700	2½ lbs.	Allen Billmyer	Motor dr.
675	24 oz.	Spencer	Motor dr.
250	16 oz.	Spencer	Motor dr.

BLOWERS

C.F.M.	St. Pres.	Make	Type
100-60000	¼"-5"	Buffalo	Various
100-15000	¼"-16 oz.	American	Various

ROTARY PRESSURE BLOWERS

C.F.M.	Press	Make	Type
10000	2 lbs.	Roots	Belt dr.
6000	3 lbs.	Roots	Belt dr.
3000	3 lbs.	Roots	Belt dr.
2000	3 lbs.	Sturt.	Belt dr.
1000	3 lbs.	Roots	Belt dr.
200	5 lbs.	Baker	Direct dr.
110	15 lbs.	Beach R.	Belt dr.

VACUUM PUMPS

1000	15 in.	Roots	Belt dr.
350	27 in.	Worth	Belt dr.
100	high vac	Beach R.	Gear dr.
100	27 in.	Deane	Belt dr.
100	29 in.	Devine	Belt dr.

MOTORS (3 ph. 60 cy.)

H.P.	Make	Volts	Speed	Type
300	G.E.	2300/4000	1800	Syn
150	West.	440	700	CS
125	G.E.	220	1150	Vertical
100	Lincoln	220	1750	
60	West.	220	1750	Co
50	G.E.	2300	1750	I
50	West.	220	850	CCI
50	West.	220	570	CS
40	G.E.	220	870	342
30	G.E.	220	1750	312
30	Wagner	220	850	el. rg.
30	Wagner	220	1150	

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Transformers up to 5000 Kva.—3—2500 Kva.—9—300 Kva., 3—500 Kva. Number of smaller sizes.

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SYNCHRONOUS MOTORS
3 phase, 60 cycle, A.C.

1—Burke 300 HP 900 RPM 440/220 Volt
1—Ideal 50 HP 600 RPM 2300 Volt

SLIP RING MOTORS, 3 phase, 60 cycle

Allis-Chalmers 250 HP 600 RPM 440 Volt

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150 KW Westinghouse "factory built" Synch. Motor Generator Set, Type SK Generator for 250 volts DC compound wound interpole, 225 HP type G Synch. Motor for 3/60/2300 volts, speed 900 RPM, complete with Westinghouse Switchboards.

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Excitation, 125 volts, 42 amps., continuous full load.
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Several Westinghouse 90", black marine with meters.

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"Fairbanks-Morse" 4 cycle Diesel engine 60 HP 1200 RPM direct connected to Fairbanks-Morse generator, 80 KVA, 50% P.F., 3 phase 60 cycles, 240 volts, complete with switchboard and auxiliaries.

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4—72" x 18' HRT boilers including a 637 KVA General Electric condensing turbine. Complete plant.
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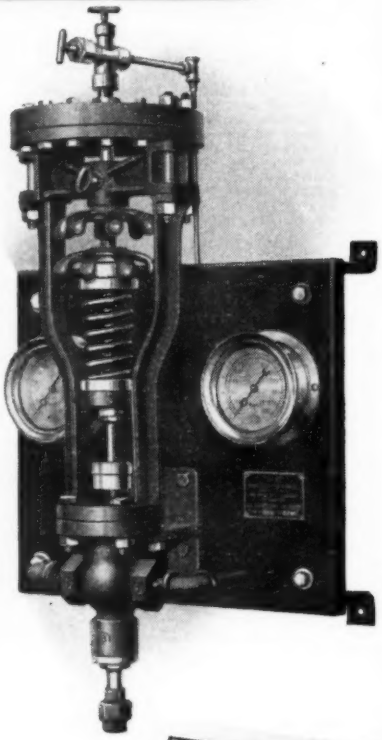
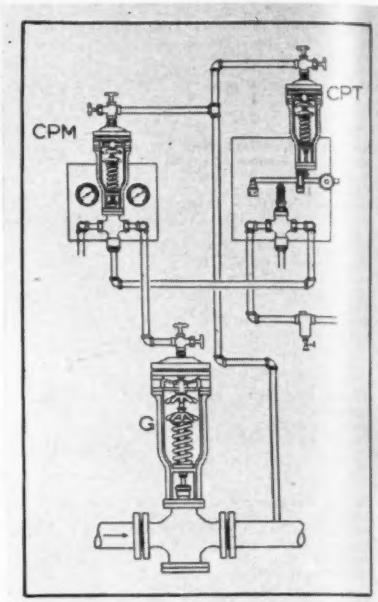
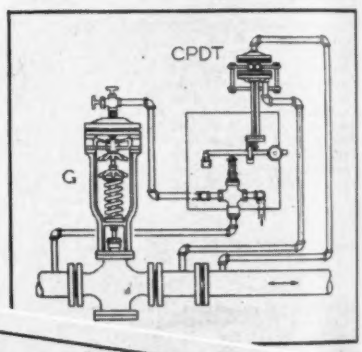
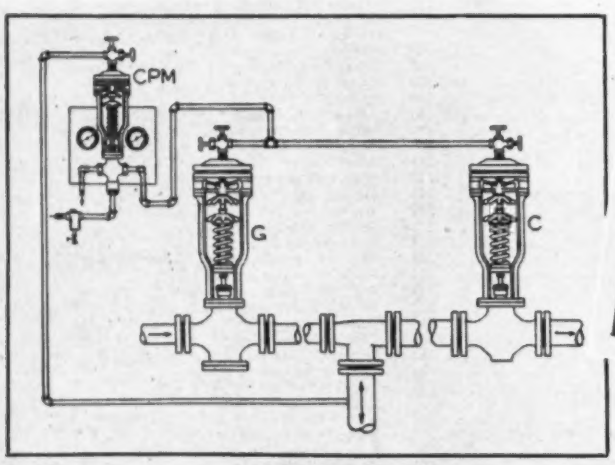
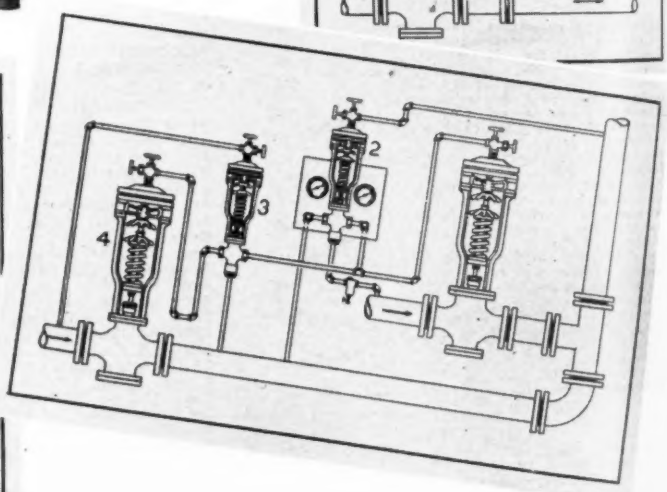






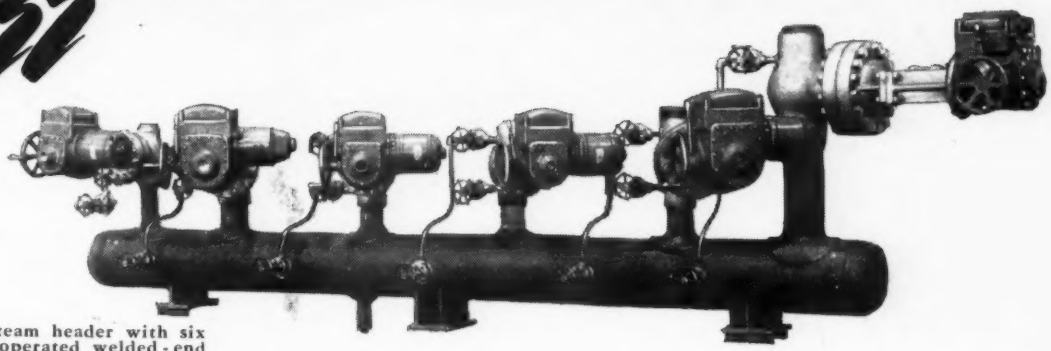




Swartwout **POWER PLANT EQUIPMENT**

THE SWARTWOUT COMPANY • 18511 Euclid Ave., Cleveland 12, Ohio

Puzzle FOR PIPING EXPERTS



Main steam header with six motor - operated welded - end valves – one of the many types of assemblies that require Grinnell's complete Pipe Fabrication facilities and "know-how".

With piping assemblies for modern industry becoming more and more complex, many specifications look like puzzles specially prepared for piping experts.

But Grinnell Pipe Fabricating specialists have never been stumped by "puzzles" like this – for good reason. They have all the *specialized* shop equipment necessary, in three modern pipe fabrication plants, to meet any requirements for fabricating piping for high pressure, high temperature service and for the most intricate assembly — — work that could not possibly be done in the field.

Make use of Grinnell's complete engineering and pipe fabrication facilities whenever plans call for a shop-fabricated job.

GRINNELL COMPANY, INC.
Executive Offices, Providence 1, R. I.

Pipe Fabrication Plants:

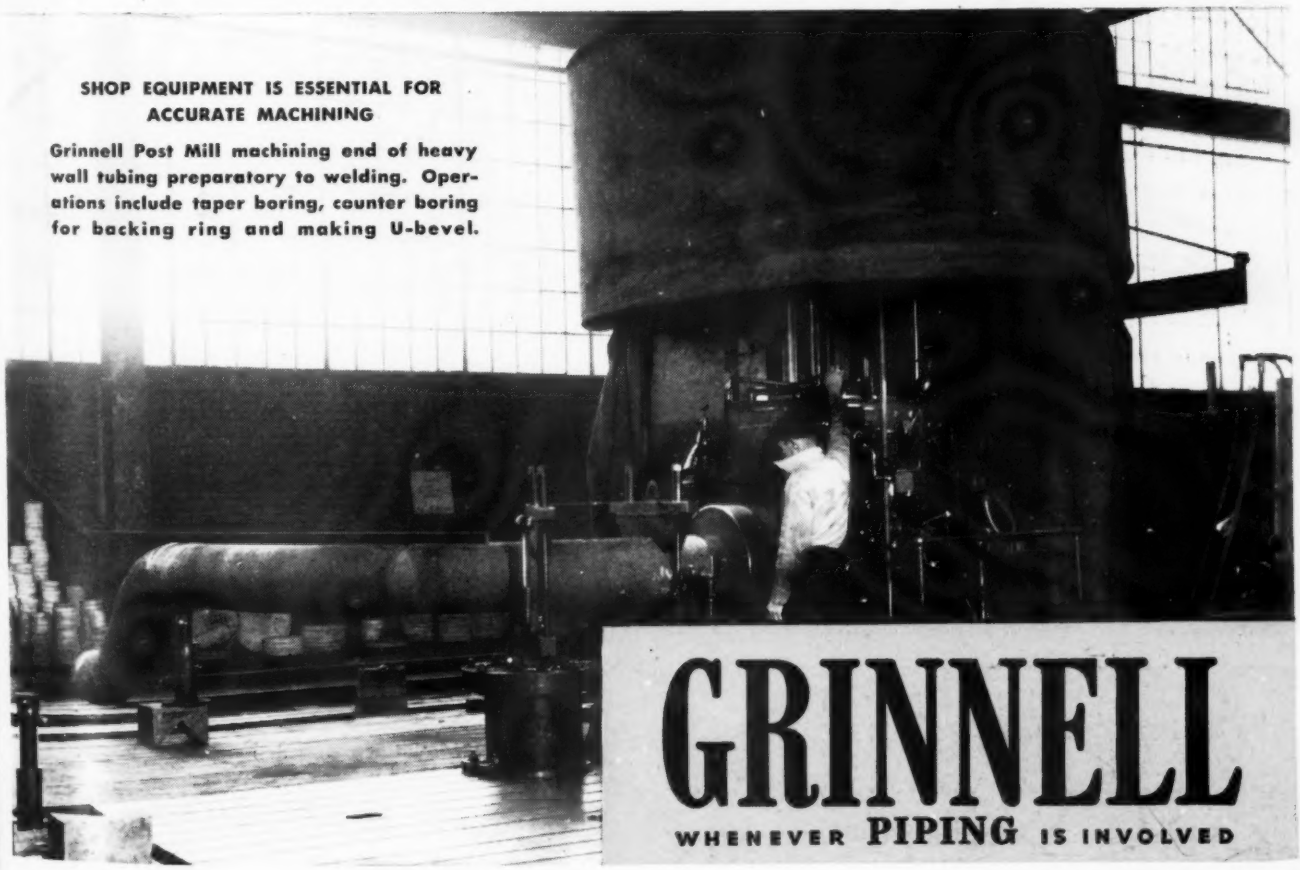
Providence, R. I. Atlanta, Ga. Warren, Ohio

Branches and Warehouses:

Atlanta 2, Ga.	Los Angeles 13, Cal.	Providence 1, R. I.
Charlotte 1, N. C.	Minneapolis 15, Minn.	St. Louis 10, Mo.
Chicago 9, Ill.	New York 17, N. Y.	St. Paul 2, Minn.
Cleveland 14, O.	Oakland 7, Cal.	San Francisco 7, Cal.
Houston 1, Tex.	Philadelphia 34, Pa.	Seattle 1, Wash.

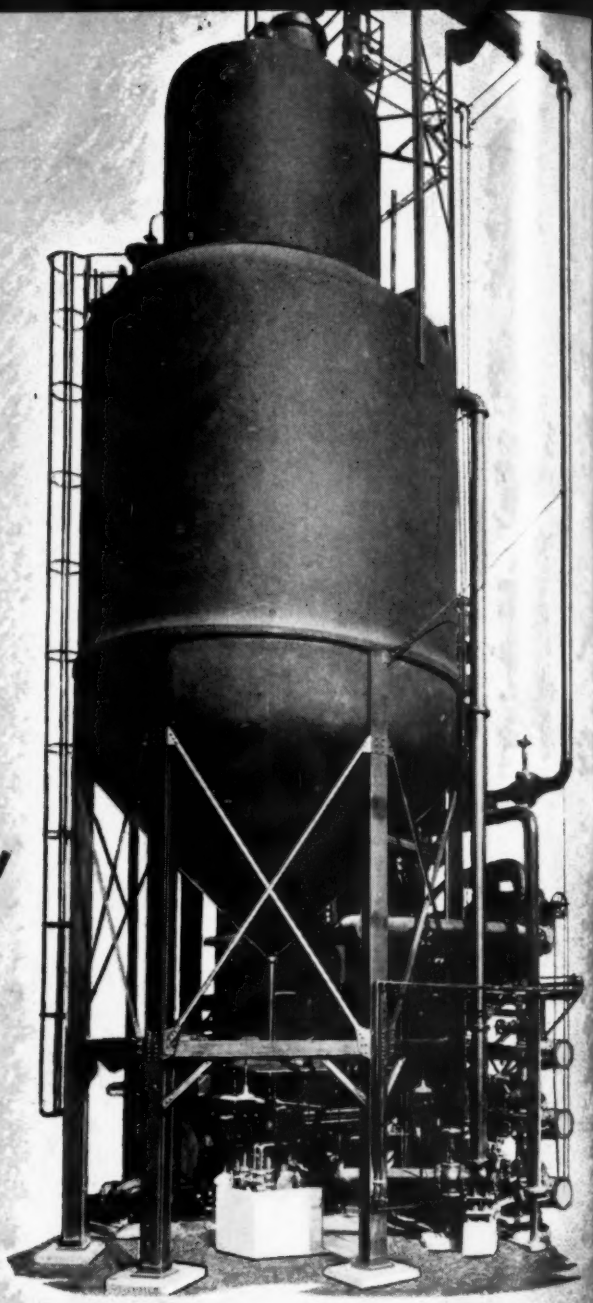
SHOP EQUIPMENT IS ESSENTIAL FOR ACCURATE MACHINING

Grinnell Post Mill machining end of heavy wall tubing preparatory to welding. Operations include taper boring, counter boring for backing ring and making U-bevel.



GRINNELL

WHENEVER **PIPING** IS INVOLVED



"How can it PREVENT CORROSION in our boilers?"

IT REMOVES OXYGEN AND FREE CO_2 from the Feedwater!

THE Deaerating Heater shown above is just one of the many types of Permutit* water conditioning equipment that are helping power plants deliver the biggest loads in history. Permutit prevents boiler-scale, corrosion, foaming and priming—gives Chief Engineers complete control of water quality.

Permutit processes include Hot and Cold Lime Soda Softeners, Spaulding Precipitators, Zeo-Karb* Water Conditioners, Degasifiers, Silica Removal and Continuous Blowoff equipment. Permutit Demineralizers produce a low-cost substitute for evaporated water.

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